16-40BC400-5

INSTRUCTION BOOK

FOR

RADIO TRANSMITTERS BC-400-B, BC-400-C, BC-400-D and BC-400-E

MANUFACTURED BY

RADIO RECEPTOR COMPANY, INC.

NEW YORK CITY

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PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

Order No. 6575-N. Y.-41 Dated: June 30, 1941
2486-Phila-42 Dec. 10, 1941
2988-Phila-42 Dec. 22, 1941
4703-Phila-42 Jan. 23, 1942

394-(7-42)

ENGINEERING ASSOCIATES LTD
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SAFETY NOTICE

HIGH VOLTAGE IS USED IN THIS EQUIPMENT AND MAY BE DANGEROUS TO LIFE IF PERSONNEL SHOULD COME IN CONTACT WITH CERTAIN PARTS OR CONNECTIONS.

SAFETY INTERLOCKS HAVE BEEN PROVIDED ON ACCESS DOORS. THE OPERATOR OR ELECTRICIAN SHOULD USE DISCRETION WHILE MAKING ADJUSTMENTS OR REPAIRS. POWER SHOULD ALWAYS BE TURNED OFF BEFORE CHANGING TUBES OR MAKING INTERNAL ADJUSTMENTS.

GROUNDING, AFTER POWER HAS BEEN REMOVED, OF THE PART BEING WORKED ON BY MEANS OF A TEMPORARY WIRE IS URGED WHENEVER POSSIBLE. FILTER CONDENSERS MAY RETAIN A CHARGE AFTER POWER IS TURNED OFF DUE TO AN OPEN CIRCUIT IN A BLEEDER RESISTOR.

STRICT ATTENTION SHOULD BE PAID TO THE SAFETY NOTICES POSTED ON THE TRANSMITTER.

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A. DESCRIPTION OF EQUIPMENT

1. SUMMARY OF TRANSMITTER CHARACTERISTICS

Power Output	
Unmodulated Carrier	5 Watts
Carrier, 100% Modulated	7½ Watts
Carrier Frequency	75 Megacycles
Modulation Frequency	3000 CPS
Frequency Stability	
Carrier	±7500 CPS
Modulation	±50 CPS
Power Supply (for full rated output)	
Frequency	60 CPS ±2%
Voltage	95-125 Volts
Current (115 V. 60 cps)	4.18 Amps.
Power (115 V. 60 cps)	480 Watts
Power Factor (110 V. 60 cps)	78%
Net Weight	350 Pounds

Vacuum Tube Complement

Symbol	No. Req.	Army Type	Commercial Type
V1, V2	2	VT-115	6L6
V3, V4	2		815
V10, V11, V16	3	VT-84	6Z4/84
V12, V13, V14, V15	4	VT-145	5Z3
V5, V6, V7, V8	4	VT-96	6N7
V9	1	VT-66	6F6

2. GENERAL DESCRIPTION

a Purpose—Each of Radio Transmitters BC-400-B, BC-400-C, BC-400-D, and BC-400-E was designed by the Radio Receptor Company in accordance with the U.S. Army Signal Corps Specification No. 171-195, for use as a radio marker facility operating on a frequency of 75 megacycles.

The purpose of this equipment is to radiate a vertical beam to mark definitely some point of strategic importance to military aircraft in flight in the immediate area.

The essentials of a marker installation consist of a radio transmitter, a radio frequency transmission line and a radiating system.

b Mechanical Arrangement.—The transmitter unit is assembled in a welded steel frame 47⅝″ high, 23¼″ wide, and 18-3/16″ deep. This frame supports all the transmitter units as well as the sheet metal cabinet and front panel trim.

The transmitter is built up of individual units, each unit consisting of a bent aluminum chassis on which are mounted the components for the unit. The individual units are mounted on the rear of the steel frame. Terminal boards for the interconnection wires are mounted on each chassis.

Ventilation is provided by natural draught through louvers in the side and rear of the cabinet. The cabinet has a back door which makes all vacuum tubes and adjustments accessible from the rear of the transmitter.

The transmitter is divided into discrete units as follows: first and top, radio frequency unit; second, modulator unit; third, power supply unit; fourth, bias unit; fifth, power control unit; sixth, voltage regulator unit.

3. OVERALL ELECTRICAL CHARACTERISTICS OF THE TRANSMITTER

a Power Output.—The transmitter delivers an unmodulated carrier power of 5 watts into a radio frequency transmission line terminated in its characteristic impedance of 144 ohms. The transmitter will deliver 5 watts of unmodulated carrier power into any resistance load between 50 and 500 ohms. Output coupling is continuously adjustable from the front panel and the 100% modulated carrier output power may be reduced to zero by means of this control.

b Modulation.—The final power amplifier is plate modulated at a frequency of 3000 cps. This frequency is generated by a vacuum tube oscillator and may be varied plus or minus 300 cycles by means of an adjustment located on the modulator chassis. The oscillator output is applied to a class A amplifier which drives the class B operated modulator. The degree of modulation may be adjusted by means of a modulation level control which is mounted on the front panel. A vacuum tube voltmeter circuit provides an indication of modulation percentage. The voltmeter measures audio frequency voltage at the output terminal of the modulation transformer. The meter scale is calibrated from zero to 100%, and by means of adjustment No. 6 may be adjusted to indicate percentage modulation at a fixed power output.

c Radio Frequency Unit.—The radio frequency unit consists of four stages, namely, the crystal oscillator-multiplier, two additional multipliers, and a modulated power amplifier.

The quartz crystal operates at a frequency of 4166.67 kc. This frequency is multiplied by two in the plate circuit of the crystal oscillator so that 8333.34 kc. is supplied to the input of the second multiplier. The frequency is multiplied by three in the next stage, producing 25.0 megacycles at the input of the third multiplier. The frequency is again multiplied by three in the next stage, producing a frequency of 75 megacycles. The fourth stage is a modulated class C amplifier. Although screen grid type tubes are used, neutralization is desirable at this frequency and is therefore provided.

d Power Supply and Line Requirements.—The equipment will operate from a single phase power supply having a nominal voltage of 115 volts and a frequency of 60 cps. All power components are also suitable for operation from a 58-62 cycle supply.

An automatic voltage regulator is used in each transmitter. It permits operation from a 60 cycle supply whose voltage varies from 95 to 130 volts. The nominal output voltage of the regulator is 115 volts so that in case of failure the regulator can be removed from the power supply circuit and the equipment operated directly from a 115 volt line. Two switches are provided on the voltage regulator chassis to remove the regulator from the circuit in case of such failure.

Three d-c power supplies are incorporated in each transmitter, namely, a radio frequency plate supply, an audio frequency plate supply, and a relay and fixed bias supply.

The radio frequency plate supply has a nominal d-c output of 400 volts. Resistors are used to drop this voltage to the value required for proper operation of the tubes. The output voltage may be reduced in three steps to 350 v, 285 v, or 210 v by means of a power switch which is mounted on the front panel and simultaneously reduces the audio frequency plate voltage proportionately. This power supply furnishes power to the plate and screen of all tubes operated at radio frequency.

The audio frequency plate supply has a nominal d-c output of 300 volts. Resistors are used to drop this voltage to the value required for proper operation of the tubes. The output voltage may be reduced in three steps to 275 v, 220 v, or 155 v by means of a power switch which is mounted on the front panel and simultaneously reduces the radio frequency plate voltage proportionately. This power supply furnishes power to the plates and screens of all tubes operated at audio frequency.

The bias supply furnishes 50 volts of fixed bias for the radio frequency amplifier tubes and also supplies power to actuate the plate supply relays.

Filament power for all tubes is provided by two filament transformers. One transformer supplies power for the radio frequency plate and audio frequency plate rectifier filaments. The second transformer supplies power to all other filaments, including the bias rectifier, vacuum tube voltmeter and bias isolator.

e Control Circuit Function.—The transmitter is equipped with two main line switches of the circuit breaker type which provide overload protection in case of circuit breakdown.

The transmitter is also equipped with filament and plate switches of the circuit breaker type which provide overload protection in case of circuit breakdown. Pilot lights are provided to indicate that the main line, filament and plate circuits are operating.

4. DETAILED DESCRIPTION OF COMPONENT UNITS

A complete schematic diagram of the transmitter is shown in Figure 7.

a Voltage Regulator—The voltage supplied to the primary of the power transformer is held constant at 115 volts ±2% for all values of line voltage between 95 and 130 volts by means of a voltage regulator. The regulator is rated at 400 volt amperes output. It is located on the bottom shelf of the transmitter and is completely self-contained. Two switches located on the same chassis are provided to remove the regulator from the circuit and connect the transmitter directly to a 115 volt 60 cps line.

These switches are sealed in the REGULATOR IN position to prevent accidental removal of the regulator from the circuit. Location of the switches and safety seal is shown on Fig. 6.

Referring to schematic diagram, Fig. 4, operation of the voltage regulator is as follows:

When an alternating current of low voltage is impressed across the primary winding, the magnetic flux created induces a voltage in winding (2). Because of the reluctance of the air-gap in the shunt path, this voltage roughly approximates the turn-ratio voltage. As the voltage across the primary is increased, more flux threads through part B of the coil structure. When this flux density becomes such that the inductive reactance, as viewed from winding (2), equals the capacitive reactance of the condenser C at the frequency of the exciting voltage, winding (2) resonates as a series resonance circuit and the voltage appearing across it rises rapidly to a stable, predetermined value which may be several times the calculated turn-ratio voltage. This has the effect of increasing the magnetic density in that portion of the magnetic circuit on which the resonant winding is wound (part B), and of greatly reducing the relative reluctance of the shunt system, so that subsequent variations in flux, produced by changes in the primary circuit, are largely absorbed by the shunt system and the voltage change in the resonant circuit is small. It only remains to compensate for this small change, and that is accomplished by winding (3).

The shunt system also operates to loosen the effective coupling between the resonant circuit and the primary winding, so that once resonance is attained, the primary is required to supply only enough energy to overcome the iron and copper losses of the system in order to maintain the oscillation.

Since the voltage across winding (2) is stable, once resonance is attained, the resonant circuit may be used as the basis of the constant output voltage of the transformer. The output of the transformer can be obtained by tapping across a portion of, or all of, the resonant winding, or from an additional output winding (4) wound over the resonant circuit and insulated from it. In either case the compensating winding (3) is connected in series with the output and opposed to it. When this winding is so proportioned that the change in voltage induced in it by a given change in primary voltage, is roughly equal to the change appearing in the output, the resultant output voltage remains constant, and independent of voltage variation in the primary circuit.

The efficiency and power factor of the regulator at rated loads are practically constant for all line voltages between 95 and 130 volts, inclusive.

The a-c line voltmeter on the front panel indicates output voltage of the regulator and has an accuracy of ±5%.

The regulator is provided with four terminals, two on each side of its case. The pairs of terminals are marked PRIMARY and SECONDARY.

b *R-f and Audio Power Supply.*—The r-f power supply provides plate and screen voltages for all tubes operating at radio frequency. These tubes are:

Oscillator Multiplier V-1
Second Multiplier V-2
Third Multiplier V-3
Power Amplifier V-4

The r-f power supply is a single phase full-wave high-vacuum rectifier designed to operate from a 115 volt 60 cps source. It is rated to deliver 0.275 amps. at 400 volts d-c. A tap switch, which is mounted on the front panel, is provided to reduce the output voltage to 350 v, 285 v, or 210 v in three steps and simultaneously reduces the audio output voltage proportionately. The voltage is reduced by protective resistors to give the correct operating voltages for the plate and screen grids of the tubes.

The r-f power supply is located on the power supply chassis. It consists of the following components:

Plate Transformer T-4
Filament Transformer T-3
Filter Reactor L-1
Filter Capacitor C-3
2 Type 5Z3 Rectifier Tubes V-14 and V-15
Tap Switch S-3

The audio power supply furnishes plate and screen voltages for all the tubes operating at audio frequency. These tubes are:

Audio Oscillator V-9
Drivers V-7, V-8
Modulators V-5, V-6

The audio power supply is a single phase full-wave thermionic rectifier designed to operate from a 115 volt 60 cps source. It is rated to deliver 0.2 amps. at 300 volts d-c. A tap switch, which is mounted on the front panel, is provided to reduce the output voltage to 275 v, 220 v, or 155 v in three steps and simultaneously reduces the r-f output voltage proportionately.

The audio power supply is located on the power supply chassis (unit #3). It consists of the following components:

Plate Transformer T-5
Filament Transformer T-3
Filter Reactor L-2
Filter Capacitor C-2
2 Type 5Z3 Rectifier Tubes V-12 and V-13
Tap Switch S-3

S-3 and T-3 are common to both the audio and r-f power supplies. When working on the power supply unit, it should be kept in mind that the secondaries of filament transformer T-3, although delivering only 5 volts, are at a high voltage to ground.

c *Bias and Relay Power Supply.*—A source of 50 volts of fixed bias for the grid of the third multiplier and power amplifier, and power to actuate the plate relay, is provided by means of a single phase full-wave high-vacuum rectifier employing a single type 84 tube, designed to operate from a 115 volt 60 cps source. Components of this bias and relay power supply are located on the bias and relay chassis and consist of the following:

Plate Transformer T-6
Filament Transformer T-2
Filter Resistor R-1
Filter Capacitor C-1

T-6 is provided with a tapped primary to obtain various output voltages. The proper tap has been selected at the factory and no further adjustment should be required.

The primary functions of this bias and relay power supply are:

(1) To furnish a source of grid bias to limit the plate dissipation of the above mentioned r-f stages in case of loss of excitation by failure of any preceding stage.

(2) To prevent self-oscillation or parasitic oscillation of the stages biased by this supply in case of loss of excitation.

(3) To furnish a source of power to actuate the plate relay.

d Modulation System.—The modulator stage consists of a pair of 6N7 twin-triode tubes connected in push-pull parallel and operating class B. A balanced audio-frequency voltage is fed to the grid from driver transformer T-8. Modulation transformer T-9 matches the output impedance of the modulator tubes to the load impedance which consists of the plate and screen grid circuits of the class C modulated amplifier V-4. The d-c plate current for the modulated amplifier flows through the secondary winding of modulation transformer T-9. The primary winding is center-tapped and brought out to terminals 1, 2 and 3. The secondary is tapped and brought out to terminals 4, 5 and 6. Connections to the plate and screen grid circuits of the class C amplifier are made through terminals 4 and 6.

The driver consists of a pair of 6N7 twin-triode tubes connected in push-pull parallel and operating class A. A balanced audio-frequency voltage is fed to the grid from the modulation control which consists of a dual potentiometer R-5 connected across the output winding of oscillator transformer T-7. Driver transformer T-8 matches the output impedance of the driver tube to the modulator grid. Cathode bias is obtained by resistor R-4. The primary winding is center-tapped and brought out to terminals 1, 2 and 3. The secondary winding is also center-tapped and brought out to terminals 4, 5 and 6.

The audio oscillator consists of a 6F6 pentode tube connected in a conventional oscillator circuit employing inductive feedback to the grid. Proper bias for oscillator operation is obtained by means of cathode bias resistor R-3. Resistor R-2 is a grid protective resistor to prevent injury to circuit components should the control grid short circuit to the screen grid or plate.

The audio oscillation transformer T-7 comprises three windings, namely, a primary, a grid feedback and a center-tapped output winding. Connections to the winding are brought out to terminals numbered 1 to 7. Terminal #1 connects to the oscillator screen grid and to the positive plate voltage supply; #2 to the oscillator plate; #3 to the oscillator grid; #4 to R-2; #5, #6 and #7 to the modulation control. Terminal #6 is the output winding center-tap terminal and is connected to ground.

The primary winding of the audio oscillation transformer has a nominal inductance of 80 mh. A matched pair of condensers C-4 and C-5 having a total capacity of .035 mfd. are connected across this winding. The transformer is provided with an adjusting screw located on top of T-7. The adjusting screw permits the oscillator frequency to be varied ±300 cycles. The frequency is adjusted to 3000 cps at the factory and no further adjustment should be required.

The modulation indicator is a vacuum tube voltmeter and measures the audio frequency voltage across the output terminal of T-9. The voltmeter consists of a half-wave rectifier using a Type 84 tube, a multiplier resistor and a 0-1 milliammeter. Two-thirds of the meter scale is calibrated from 0 to 100%. The multiplier consists of a fixed (R-10) and a variable (R-21) resistor. The variable resistor is used to adjust the voltmeter to read 100% modulation at a fixed carrier power output.

e Crystal.—The carrier frequency of the transmitter is controlled by a quartz crystal. Two crystals are provided with each transmitter and either of these crystals may be selected for operation by means of a crystal switch which is mounted on the front panel. Access to these crystals is made through a door on the front panel. These crystals have been carefully cut and ground, not only to produce the proper frequency, but also to have a very low temperature frequency co-efficient so that the variation of crystal frequency will be no more than .01% over a temperature range of +15 to +50 degrees C. without temperature control. The crystal is securely mounted in a sealed ceramic holder so that moderate vibration will not shift the crystal, thus causing the frequency to shift from the original value. Connections from the crystal are brought out of the holder on two nickel plated studs on opposite sides of the holder. The vertical height of the two studs is different, thus preventing the crystal holder from being inserted in the wrong position. The lower stud is connected to the metal plate on the bottom of the crystal holder since it is intended that the crystal operate with one electrode grounded. In the transmitter, the terminals of the crystal holder slip under two spring contacts that hold it in place and also serve as connectors.

The crystal door is equipped with a safety interlock switch which disconnects all dangerous voltages from the transmitter when the crystal door is open, thus protecting the operator when making adjustments or replacing the crystals.

f Oscillator Multiplier Circuit.—A type 6L6 tube, V-1, is used as a crystal controlled, tuned cathode oscillator and frequency multiplier. Capacitor C-15 and r-f choke L-3 comprise the tuned cathode circuit. Capacitor C-17, C-18 and inductance L-4 comprise the plate tank circuit and are tuned to the second harmonic of the crystal frequency. Capacitor C-32 serves to feed back sufficient voltage to rapidly activate the crystal. Grid bias for proper operation of the oscillator is obtained from grid leak R-17. The low potential end of L-4 is bypassed to ground by capacitor C-18 which is also a part of the plate tank circuit. Power for the screen circuit is obtained through dropping resistor R-18 and is bypassed to ground by capacitor C-16. Plate power for the crystal tubes is fed through a protective resistor R-11, the oscillator-multiplier plate current meter M-8 and the inductance L-4. The oscillator plate meter has capacitor C-11 connected across it to bypass r-f current. Crystal switch S-4 serves to place either of the two crystals in the circuit and short circuit the inoperative one.

g Second Multiplier Circuit.—A type 6L6 tube, V-2, is used to multiply the frequency three times. It receives excitation from a tap on the oscillator-multiplier plate tank circuit by means of the coupling capacitor C-19. Grid bias is obtained by grid leak resistor R-19. Cathode resistor R-20 serves to limit the plate current in case of excitation failure. The cathode is bypassed to ground by capacitor C-21. Capacitor C-22, C-23 and inductance L-5 comprise the plate tank circuit and are tuned to the sixth harmonic of the crystal frequency, 25.0 megacycles. The low potential end of L-5 is bypassed to ground by capacitor C-23 which is also a part of the plate tank circuit. Power for the screen circuit is obtained through dropping resistor R-8. The screen grid is bypassed to ground by capacitor C-20. Plate power is supplied through dropping resistor R-12, plate milliammeter M-9 and inductance L-5. The oscillator-multiplier and second multiplier are mounted on a common chassis (shelf 1, r-f unit). Wiring diagram for the oscillator and multiplier is shown on Fig. 15.

h Third Multiplier Circuit.—A type 815 twin beam-power tube is used to multiply the frequency three times and is connected in push-pull. The tube receives excitation from inductance L-6 which is inductively coupled to inductance L-5, the plate tank circuit of the second multiplier and is tuned to the same frequency by capacitor C-24. Control grid bias is obtained partly from grid leak resistor. R-16. Protective bias is obtained from the bias supply through bias isolator tube V-10. Control grid current is measured through grid milliammeter M-4, and together with the power amplifier grid current is used to actuate and hold the bias interlock relay. The rotor of grid tuning capacitor C-24 and the cathode of the tube are connected directly to ground. Power for the screen grid is obtained through dropping resistor R-8 which also supplies power to the screen grid of the second multiplier. The screen grids are bypassed to ground by capacitor C-25. Capacitor C-27 and inductance L-7 comprise the plate tank circuit and are tuned to a frequency of 75 megacycles. Plate power to the tube is supplied through dropping resistor R-9, plate milliammeter M-5 and inductance L-7. Grid milliammeter M-4 and plate milliammeter M-5 are bypassed for radio frequency current by capacitors C-8 and C-9, respectively. The filaments of the two tube sections are paralleled for six volt operation.

i Power Amplifier Circuit.—A type 815 twin beam-power tube is used as a modulated class C amplifier. The tube receives excitation from inductance L-8 which is inductively coupled to inductance L-7, the plate tank circuit of the third multiplier and is tuned to the same frequency by capacitor C-28. Control grid bias is obtained partly through grid leak resistor R-15. Protective bias is obtained from the bias supply through bias isolator tube V-10. Control grid current is measured through grid milliammeter M-10, and together with the third multiplier grid current is used to actuate and hold the bias interlock relay. The cathodes of the tube are connected directly to ground. Modulated power for the screen grid is obtained through dropping resistor R-13. The screen grids are bypassed to ground by capacitor C-29. Capacitor C-30 and plate line inductance L-9 comprise the plate tank circuit at 75 megacycles. Modulated plate power to the class C amplifier is supplied through dropping resistor R-14, plate milliammeter M-11 and plate line inductance L-9. Grid milliammeter M-10 and plate milliammeter M-11 are bypassed for radio frequency by capacitor C-13 and C-14, respectively. The filaments of the two sections of the tube are paralleled for six volts operation. Although screen grid type tubes are used in the power amplifier, neutralization is found to be desirable and is therefore provided. Inductive neutralization is accomplished by inductance L-12 inductively coupled to inductance L-8 and link coupled to inductance L-11 which is inductively coupled to inductance L-9. Adjustment #7 is provided to vary degree of coupling between L-11 and L-9.

j Output Coupling.—The output coupling coil L-10 is inductively coupled to plate line inductance L-9 and the percentage of coupling is continuously variable from 0 to 100% by means of the antenna coupling control mounted on the front panel. The coupling coil is designed to couple an unmodulated carrier power of five watts into a radio frequency transmission line terminated in its characteristic impedance of 144 ohms. The coupling coil will also deliver 5 watts of unmodulated carrier power into any resistance load between 50 and 500 ohms.

k Control Circuits and Relay System.—Main line, filament and plate power switches are located on the bottom section of the front panel.

Arranged horizontally in groups of two on either side of the control panel are four circuit breaker type switches. From left to right numbers 1 and 2 are the main line switches, number 3 the filament supply switch and number 4 the plate supply switch. On the lower center of the panel are located three pilot lamps, white, green, and red, indicating respectively main line, filament and plate circuits.

On the top center of the panel is the a-c line voltmeter which measures the input voltage to all power transformers.

Two relays are included in the transmitter, the bias interlock relay RL-1 and the plate supply relay RL-2. They are located beneath a protective cover on the bias supply chassis. A type 84(V-10) bias isolator tube, main door safety interlock switch S-5, and the crystal door safety interlock switch S-6, comprise the rest of the control circuit.

Operation of the control and relay system is as follows:

The main line switches control the main power line to the transmitter. The filament switch controls all filament voltages to the transmitter and the plate switch controls all plate and bias voltages.

A bias interlock relay is used in conjunction with the bias isolator tube to prevent application of plate voltage to the tubes if the bias supply fails.

A plate relay is used in conjunction with the bias interlock relay to control the application of plate voltage.

The safety interlock switches are in series with the plate power and bias supply input voltage and serve to protect the operating personnel when making adjustments on the transmitter.

B. INSTRUCTIONS FOR INSTALLATION

1. UNPACKING

This section, in addition to giving instructions for unpacking the transmitter, describes the manner in which the material supplied by the contractor for a complete installation is packed for shipment. This information is included both to facilitate unpacking and to provide information for repacking the transmitter.

The equipment shipped to each location consists of the following:

a One transmitter unit
b Two sets of tubes
c Two crystals mounted in holders
d One set of spare parts

The above equipment will be packed in two wooden cases numbered 1 and 2.

Wooden case #1 is 54¼″ x 27¼″ x 23¾″, weighs 480 lbs. and contains one transmitter unit.

Wooden case #2 is 32½″ x 16½″ x 15″, weighs 58 lbs. and contains four cartons as follows:

Carton #1 contains one set of spare parts
Carton #2 contains one set of spare tubes
Carton #3 contains one set of tubes
Carton #4 contains two type FT-164 mounted crystals

The transmitter unit is packed complete except for tubes and crystals. All plug-in type resistors have been secured to their holders with ¾″ cotton tape. Wooden cross pieces are bolted to the top of the two large power transformers and choke coils and two vertical legs are attached to these to support their vertical weight. The unit is then packed in a layer of felt wadding and water-proof paper. Next it is placed on a wooden base constructed of one inch dressed stock in convenient widths to form a rectangle 27¼″ x 23¾″. The top is constructed the same as the base and after the top has been placed in position, the wooden sides constructed of one inch dressed stock are nailed to the top and base sections forming a tightly fitting packing case. This packing is illustrated in Fig. 38.

The packing case should be transported in an upright position.

To unpack, cut the banding and remove the sides with a nail puller. Prying the sides off may result in injury to the transmitter unit. The top and protective paper are then removed and the transmitter unit is ready to be placed in position. Before placing in operation remove the wooden braces from the transformers and chokes and the cloth tape from the plug-in resistors.

2. INSTALLATION OF TRANSMITTER

a *Mounting.*—The base of the transmitter is provided with four ⅜″ holes for mounting. Correspondingly placed holes should be drilled in the floor for ⅜″ lag screws. See Fig. 41A. Connections to the a-c line input and ground should be made before the transmitter is mounted to the floor.

When mounting the transmitter, sufficient clearance space between the transmitter and surrounding objects should be allowed to facilitate opening the rear door, tuning the transmitter and proper ventilation. Suggested clearances are shown in Fig. 41.

It is desirable to consider the layout of the antenna installation before permanently placing the transmitter in position. The transmitter should be mounted in such a position that the transmission line feeders run directly to the antenna terminals without undesirable bends.

b *Connections.*—The following external connections are required to place the transmitter equipment in operation:

(1) 115 v 60 cycle supply line
(2) Ground to frame
(3) R-f transmission line

Underneath the input warning nameplate on the bottom shelf of the transmitter is located terminal strip #11 with two terminals designated, respectively, 55 and 56. The a-c line input connection should be made to these terminals by running two #16 AWG lead sheath conductors or the equivalent through the Adalet end bushing and ½″ conduit supplied with the transmitter. BX or conduit adapters may be attached to the transmitter by removing the Adalet insulated end bushing and replacing it with the desired adapter. The transmitter frame should be connected to a good ground. Connections to the frame should be made by removing the screw and lockwasher located at the righthand rear corner of the voltage regulator chassis and mounting a lug or copper strap beneath it. This connection should be made by means of a copper strap or No. 6 AWG conductor.

The radio frequency output of the transmitter (terminals 57 and 58) is brought out to a pair of feed-thru insulators located at the rear center of the top of the transmitter. Dimension between insulator centers is 4″.

Either an open wire or concentric transmission line may be connected to these terminals. When using a concentric transmission line the conductors should be terminated away from the transmitter and connected to the antenna terminal by means of two conductors spaced 4″. See Fig. 41B.

C. ADJUSTMENT AND OPERATION

1. PREPARATION FOR USE

a Preliminary Circuit Adjustment.—These instructions are to apply only when the transmitter is first set up and are only meant to check faulty operation.

(1) Make certain that all tubes are seated in their proper sockets as marked adjacent to the socket and that the flexible plate leads are connected to the 815 tubes.

(2) Set tuning dials as indicated by tuning chart and set antenna coupling control to 10.

(3) Turn modulation control to minimum and plate power switch to position 4.

(4) Set switches marked MAIN LINE, FILAMENT, and PLATE off.

(5) Turn on power at station distribution panel.

(6) Throw the a-c line switches to the ON position. The white pilot light should be illuminated and the a-c line meter should indicate a line voltage of from 113 to 117 volts.

(7) Turn filament on by throwing the filament switch to the ON position. All filaments and the green pilot light should light.

(8) Allow approximately thirty seconds for the filaments to heat and apply the plate power by closing the switch marked TRANSMITTER PLATE. Observe the plate milliammeters. The reading of the oscillator and second multiplier plate should correspond to the values indicated on the tuning chart. The P.A. plate, P.A. grid and third multiplier plate readings will vary from those indicated on the tuning chart because the input and output capacitances of the type 815 tubes serve as a high percentage of the tuning capacity for these circuits. Retuning will therefore be necessary and the following procedure should be followed:

(a) Tune the third multiplier plate dial for minimum plate current.

(b) Tune the power amplifier grid dial for maximum grid current.

(c) Tune the power amplifier plate dial for minimum plate current.

2. OPERATION

a Preliminary Steps.—

(1) Turn off power by throwing all power switches to the OFF position.

(2) Set output coupling control to 10 (minimum).

(3) Turn modulation control to minimum position.

(4) Set tuning control as indicated by tuning chart.

(5) Throw the a-c line and filament power switches to the ON position.

(6) Apply plate power. Retune all plate circuits for minimum plate current and all grid circuits for maximum grid current.

(7) Check the power amplifier tube for neutralization by following the procedure of paragraph *d*.

(8) Adjust the antenna coupling control to give a minimum power amplifier plate current of 50 ma. This represents an approximate carrier power output of 5 watts.

b Carrier Amplitude Adjustment.—

(1) Advance the modulation control clockwise until 100% modulation is indicated on the modulation indicator.

(2) With 100% modulation adjust the antenna coupling control until sufficient power is supplied to the radiating system. The modulation indicator has been adjusted to indicate 100% modulation with an output power of 5 watts. With every change in output coupling the percent modulation should be checked and the modulation indicator adjusted accordingly.

c 100% Modulation.—To check for 100% modulation any of the following methods may be used:

(1) Connect an oscilloscope to the transmitter output by means of a loop of wire tied to the vertical plates and coupled to the transmission line. Adjust the modulation control until 100% modulation is viewed on the screen.

(2) Connect a negative peak indicator to the right-hand clip facing the rear on resistor R-14 and ground. 100% modulation is indicated by the flow of current through the negative peak indicator meter.

(3) Connect a copper oxide rectifier type a-c voltmeter, across terminals 49 and 53 on unit #1. Connect a d-c voltmeter from terminal 53 to ground on the same unit. When the a-c voltage is equal to 75% of the d-c voltage, the carrier is 100% modulated. This value takes into consideration the fact that the a-c voltmeter reads .707 of the rms peak value and also compensates for the percent distortion present in the wave form. The accuracy of this measurement is dependent upon the accuracy of the two meter scales. It is therefore advisable to adjust the modulation slightly below 100% to compensate for inaccuracies of the meters. Where more accurate measurements must be made the oscilloscope or negative peak indicator should be used.

With the transmitter set at 100% modulation adjust R-21 (adjustment #6) until the modulation indicator reads 100.

d Neutralization.—The neutralization of the power amplifier has been adjusted and the neutralizing link adjustment #7 locked at the factory.

However, some readjustment will probably be necessary whenever a new tube is inserted in the power amplifier. Proper neutralization of the amplifier is indicated when during power amplifier plate tuning maximum grid current coincides with minimum plate current.

> ***CAUTION:*** **A high d-c voltage is present near the neutralizing adjustment. When making these adjustments be sure the plate power switch is in the OFF position.**

(1) *Procedure.*—If the amplifier is improperly neutralized the following steps to adjust neutralizing link adjustment #7 should be performed:

(a) Turn off plate power and unlock adjustment #7.

(b) Change the neutralizing adjustment in small steps, turning on the plate power, retuning the power amplifier plate after each adjustment and observing the plate and grid meter relationships.

(c) When proper neutralization is obtained lock the rotor nut on adjustment #7.

(d) Recheck neutralization.

e Control Circuit and Relay Operation.—The switches and relays for control of the transmitter are properly adjusted when they leave the factory. They should require no adjustment in the field beyond that called for by the maintenance of all equipment of this type. This is covered in Section D entitled MAINTENANCE AND REPAIR.

f To Check the Operation of the Control Circuit.

(1) Before energizing the supply line to the transmitter, all power switches should be thrown to the OFF position.

(2) Throw the a-c line switch to the ON position.
    (a) White pilot lamp lights.
    (b) A-c line voltmeter indicates 116 volts.

(3) Close the filament power switch.
    (a) Green pilot lamp lights.
    (b) All filaments light.

(4) Close plate power switch.

(a) If sufficient time has been allowed for the bias rectifier to heat up, bias interlock relay RL-1 and plate relay RL-2 will operate.
    (b) Plate voltage is supplied to all tubes.
    (c) Red pilot lamp lights.
    (d) Transmitter is in operation.

Overloading any of the circuits will cause the plate, filament or main line circuit breakers to trip.

D. MAINTENANCE AND REPAIR

1. DETAILED INSTRUCTIONS FOR INSPECTION AND REPAIR

a Daily Inspection.—All meter readings should be recorded daily. A comparison of these readings from day to day will show any sudden or gradual change in tubes or operating conditions. A decrease in the reading of the plate milliammeter may indicate loss of emission in the tubes. A decrease in the reading of a group of milliammeters indicates loss of emission in one or more of the rectifier tubes. Tubes showing signs of failure should be replaced at once.

Indicating lamps should be examined and replaced if burnt out.

b Inspection Every 1,000 Hours of Operation.—The contacts of both relays should be examined for pitting and tightness. Any irregularities of the contact surfaces should be smoothed off with crocus cloth.

All relay contacts should be cleaned with carbon tetrachloride ~~of~~ or ethyl acetate.

The outside surfaces of the transmitter should be carefully dusted and cleaned.

Upon shutting down after long periods of operation, a careful examination of components should be made. This will include feeling reactors and transformers to detect signs of excessive heating.

A systematic mechanical inspection should be made and all electrical connections checked for tightness. This should include all connections at the terminal boards. Any loose screws should be carefully tightened.

The inside of the transmitter should be cleaned to remove any dust which may have accumulated. Care should be taken while cleaning not to damage tubes, insulators or other easily breakable parts.

2. TABLE OF ROUTINE INSPECTIONS AND TESTS

a Daily.—Record all meter readings. Check indicator lamps.

b Every 1,000 Hours of Operation.—Examine relays and relay contacts. Clean transmitter. Make mechanical check. Examine transformers and reactors for overheating.

3. LUBRICATION

A small amount of vaseline may be applied to the panel bushings on the r-f unit when required to insure smooth operation of the tuning controls.

4. LIST OF POSSIBLE TROUBLES AND REMEDIES

When properly installed and adjusted, any irregularities in the operation of the transmitter will be due either to misadjustment of one or more controls or to the failure of some component. If the circuit breakers trip recurrently, the transmitter should be carefully examined to locate the cause.

a Main Line Circuit Breakers Trip Recurrently.—Check line voltage to the input terminal. If the line voltage falls below 95 volts the main circuit breakers will trip.

b Plate Power Relay Does Not Operate.—

(1) Check bias rectifier tube V-11 and bias isolator tube V-10.

(2) Check for short circuit between neutralizing inductance L-12 and grid inductance L-8.

(3) Check door interlock switches for operation, making sure that door switch cable #8 is plugged into P-1.

(4) Check relays for sticky operation.

(5) Check bias filter condenser C-1 for short.

(6) Check bias resistor R-1 for open.

c All Indicating Meters Except A-c Line, A-f Voltage and Modulator Current Show No Current.—

(1) Check rectifier tubes V-14 and V-15.

(2) Check condenser C-3 for short.

(3) Check filament winding on transformer T-3.

(4) Check r-f circuit and wiring for short.

d Plate Milliammeter of One Stage Shows Abnormal Reading.—

(1) Replace tube in that stage.

(2) Check stage for opens and shorts.

e Abnormal Operation of Controls.—

(1) Check and replace bias rectifier and bias isolator tubes V-11 and V-10.

(2) Check relays for faulty operation.

f Low R-f Output.—

(1) Examine crystal oscillator plate milliammeters and compare with tuning chart. If plate current is high, switch to spare crystal.

(2) Check other stages for detuning.

(3) Check r-f plate voltage meter. If voltage is low replace rectifier tubes V-14 and V-15.

g Excessive Hum.—

(1) One or more rectifier tubes, V-11, V-12, V-13, V-14 or V-15 may be defective.

(2) Rectifier filament elements may be defective.

(3) Cathode of 6F6 or 6N7 may be shorted to heater.

5. DETAILED CHECKING

The indications of trouble listed in paragraph 4 may not show the exact location of the trouble. A systematic search is then necessary, taking each suspected circuit element and testing it.

6. TUBE TERMINALS

The operation of individual tubes may be checked by measuring the voltage between the tube elements and ground. To assist in such checking, Table 1 shows typical values of voltages for normal operation at rated output. Values of currents of individual elements in the tubes may be measured in the indirect manner; that is, to measure the voltage drop across a given resistor in the series circuit and divide it by its resistance. Typical operating currents are shown in Table 2.

7. ADJUSTMENT AND REPLACEMENT OF RELAY PARTS

All relay spare parts are numbered and their location shown on Fig. 42. Three adjustments are provided on RL-1 and one adjustment on RL-2.

a *Adjustment Relay RL-1.*—The armature spring (adjustment #1) should be adjusted to provide enough tension to return the armature to the OFF position with no voltage applied.

Adjustment #2 should be adjusted so that the relay actuates without delay when plate power is applied.

Adjustment #3 should be adjusted so that the plate power relay RL-2 follows RL-1 in unison, i.e., when bias interlock relay RL-1 closes, plate power relay RL-2 should close simultaneously.

b *Adjustment Relay RL-2.*—Adjust the armature spring (adjustment #4) so that the relay actuates easily when plate power is applied.

8. ACCESS TO UNITS FOR SERVICE

a Access to the wiring of all units excepting the r-f unit, control panel and voltage regulator is made by following the procedure outlined below. See Fig. 5.

(1) Remove the front trim mounting screws from the sides of the transmitter, and remove the trim.

(2) Remove the knobs on the modulator or power supply if these units are to be removed.

(3) Remove the mounting screws from the panel to be removed.

(4) Remove the panel.

b To gain access to the r-f unit, control panel or voltage regulator, it is necessary to remove the unit in question from the rack.

(1) The r-f unit may be removed by disconnecting the interconnecting wires to terminal strips TS-5 and TS-10, the antenna terminals 57 and 58 and removing the mounting screws from the front panel.

(2) The control panel may be removed by following this procedure:

(a) Remove interconnecting cable plug P-1 from its socket on the bias unit.

(b) Remove mounting screws from cover plate behind control panel.

(c) Remove interconnecting wires from terminal strips TS-1 and TS-6.

(d) Remove front panel mounting screws.

(e) Remove panel.

(3) To remove the voltage regulator follow:

(a) The procedure outlined above in (a) and (b).

(b) Remove interconnecting wires from terminal strip TS-6.

(c) Remove the Adalet end bushings and ½″ bond nuts from both ends of the conduit feeding the regulator chassis.

(d) Loosen the ½″ bond lock nuts from the inside of the frame.

(e) Remove the chassis mounting screws from the frame.

(f) Remove the chassis.

9. LOCATION OF PARTS

a *Vacuum Tubes.*—To find position of tubes in transmitter locate applicable unit.

Tubes are numbered from the front left to right or from bottom to top in each unit with two exceptions, V-10 and V-16. They are located in the bottom rear of the radio frequency unit.

b *Transformers.*—The transformer part numbers are based on circuit relationship. Starting from the power input T-1, filaments T-2, T-3; plates T-4, T-5 and T-6; and audio T-7, T-8 and T-9.

To find the position of a transformer refer to Fig. 6 transmitter, back view (cabinet removed).

c *Resistors and Condensers.*—Resistors and condensers are numbered according to their physical layout with certain exceptions which are noted below:

R-10—Terminal board bottom rear r-f unit.

C-31—Right bottom rear r-f unit.

C-32—Near crystal switch bottom r-f unit.

Fig. 9A shows location and relationship between parts.

d *Terminal Strips.*—Location of terminal strips is shown in Fig. 9B.

e *Inductances and Switches.*—Location of inductances and switches is based on their physical layout with one exception, switch S-6 which is located at the bottom left rear (facing back) on cabinet. The part numbers increase from bottom to top of transmitter.

f Meters.—Meters are numbered on the basis of their physical layout as shown in Fig. 9C.

10. TESTING FOR PARTS FAILURE

a Capacitors.—Use an ohmmeter to determine a dead short.

Intermittent capacitor failures may be detected by connecting a high range voltmeter in series with the capacitor. If upon applying high voltage, the voltmeter does not momentarily deflect, the capacitor is probably open. If, on the other hand, the voltmeter deflects and does not return to zero, the capacitor probably has a leakage.

b Resistors.—Use an ohmmeter to determine resistance. Where the resistor to be measured is shunted by other resistances in the circuit, it will be necessary to disconnect one of the resistor leads from the circuit before making the measurements.

c Inductors.—Visual inspection will often locate trouble in a coil. It is usually due either to an open circuit or insulation failure between turns.

d Transformers.—The rated voltages on the different transformer windings under normal load conditions are given in Table 6.

e Reactors.—The performance of reactors is best determined, provided that the filter capacitors are in good condition, from the amount of ripple in the output of the filters in which they are used. The amount of ripple can be measured by connecting an a-c voltmeter in series with a blocking capacitor across the power supply bleeder. The blocking capacitor should have a capacity of at least 2 mfd. and a voltage rating greater than the d-c voltage of the power supply. A reading of more than 1% of the d-c voltage indicates a faulty condition in the reactor.

f R-f Circuits.—Check voltages in all stages, referring to the various voltage and current tables.

g A-f Circuits.—Check a-c voltages across all transformer windings in the modulator, referring to the transformer voltage Table 6.

11. TABLES

TABLE 1

TUBE SOCKET VOLTAGES

All D-c Voltages Measured to Ground

Tube	Type	Function	Ep_1	Ep_2	Eg_1	Eg_2	Esg	Ek	Ef
V-1	6L6	Osc. Multiplier	345	—	—	—	240	0.2	6.2
V-2	6L6	2nd Multiplier	300	—	—	—	140	22	6.22
V-3	815	3rd Multiplier	225	225	150*	150*	140	0.0	6.2
V-4	815	Power Amp.	320	320	125*	125*	100	0.0	6.1
V-5	6N7	Modulator	300	300	—	—	—	0.0	6.25
V-6	6N7	Modulator	300	300	—	—	—	0.0	6.25
V-7	6N7	Driver	300	300	—	—	—	6.6	6.33
V-8	6N7	Driver	300	300	—	—	—	6.6	6.35
V-9	6F6	Audio Osc.	295	—	—	—	300	54	6.3
V-10	84	Bias Isolator	150	125	—	—	—	60	6.2
V-11	84	Bias Rectifier	502	502	—	—	—	—	6.3
V-12	5Z3	A-f Plate Rectifier	440	440	—	—	—	—	4.9
V-13	5Z3	A-f Plate Rectifier	440	440	—	—	—	—	4.9
V-14	5Z3	R-f Plate Rectifier	565	565	—	—	—	—	4.9
V-15	5Z3	R-f Plate Rectifier	565	565	—	—	—	—	4.9
V-16	84	Mod. Ind.	230	230	—	—	—	—	6.2

All the above measurements made on Signal Corps Test Set I-56-A-985.
*Indicates measurements made on 250 volt scale.

TABLE 2
OPERATING CURRENTS

Tube	Type	Function	Milliamperes D-c Plate	Screen	Grid
V-1	6L6	Osc. Multiplier	12	5.1	—
V-2	6L6	2nd Multiplier	44	6.3	—
V-3	815	3rd Multiplier (two sections)	74	8.0	3.1
V-4	815	Power Amp. (two sections)	50	29	6
V-5	6N7	Modulator (two sections)	158	—	—
V-6	6N7	Modulator (two sections)	158	—	—
V-7	6N7	Driver (two sections)	15	—	—
V-8	6N7	Driver (two sections)	15	—	—
V-9	6F6	Audio Oscillator	20	—	—
V-10	84	Bias Isolator	—	—	—
V-11	84	Bias Rectifier	29.6	—	—
V-12	5Z3	A-f Plate Rectifier	202	—	—
V-13	5Z3	A-f Plate Rectifier	202	—	—
V-14	5Z3	R-f Plate Rectifier	272	—	—
V-15	5Z3	R-f Plate Rectifier	272	—	—
V-16	84	Mod. Ind. Rectifier	—	—	—

TABLE 3
TYPICAL SET OF TEST DATA

TUNING DATA: Voltage regulator in; 100% modulation at 3000 cycles; power switch at maximum; PA plate loaded to 50 ma.; r-f power output at 5 watts.

	Meter	Meter No Excitation
Osc. Multiplier Plate	12	60
2nd Multiplier Plate	44	46
3rd Multiplier Grid	3.1	0
3rd Multiplier Plate	74	22
Power Amplifier Grid	6	0
Power Amplifier Plate	50	66
Antenna Coupling	—	
Modulator Plate — No. Mod.	78	
Modulator Plate 100% Mod.	158	
A-f Plate Volts Tap 1 Power	175	
A-f Plate Volts Tap 2 "	230	
A-f Plate Volts Tap 3 "	280	
A-f Plate Volts Tap 4 "	305	
R-f Plate Volts Tap 1 Power	220	
R-f Plate Volts Tap 2 "	300	
R-f Plate Volts Tap 3 "	350	
R-f Plate Volts Tap 4 "	400	
A-c Line Non-Regulated	95-130	
A-c Line Regulated	116	

TABLE 4
CAPACITOR OPERATING VOLTAGES

Symbol	Rated Working Volts	Measured
C-1	600	55 volts
C-2	600	300
C-3	600	400
C-4	600	6.6
C-5	600	6.6
C-6	600	0.0
C-7	600	0.0
C-8	600	0.0
C-9	600	0.0
C-10	600	0.0
C-11	600	0.0
C-12	600	0.0
C-13	600	0.0
C-14	600	0.0
C-15	600	25.0
C-16	600	240.0
C-18	600	345.0
C-19	600	345.0
C-20	600	25.0
C-21	600	140.0
C-23	600	300.0
C-25	600	140.0
C-26	600	320.0
C-29	600	100.0

TABLE 5
RESISTOR OPERATING VOLTAGES AND POWER DISSIPATION

		Watts	
Symbol	Voltage	Rated Power	Dissipated Power
R-1	370	60	10.9
R-2	0.2	2	—
R-3	54	2	.97
R-4	7.5	2	.112
R-5	16 a-c	—	—
R-6	295	60	9.25
R-7	400	60	17.8
R-8	250	60	3.57
R-9	185	60	13.7
R-10	45	60	4.05
R-11	60	60	7.2
R-12	120	60	4.8
R-13	160	60	8.4
R-14	74	60	3.62
R-15	122	2	.745
R-16	117	2	.274
R-17	17	2	—
R-18	180	3	9.25
R-19	40	3	.8
R-20	22	2	.97

TABLE 6
TRANSFORMER TERMINAL VOLTAGES

Symbol	Function	Terminals	Voltage
T-1	Voltage Regulator	Primary	95-130
		Secondary	115-117
T-2	Filament	Primary	116
		Secondary	6.6
T-3	Rectifier Filament	Primary	116
		R-f Secondary	5
		A-f Secondary	5
T-4	R-f Power Tap 1	Secondary to Ground	280
	Tap 2	Secondary to Ground	380
	Tap 3	Secondary to Ground	430
	Tap 4	Secondary to Ground	530
T-5	A-f Power Tap 1	Secondary to Ground	220
	Tap 2	Secondary to Ground	295
	Tap 3	Secondary to Ground	360
	Tap 4	Secondary to Ground	395
T-6	Bias Supply	Secondary	905
T-7	Audio Oscillator	5 - 7	32.5
T-8	Driver	4 - 6	32
T-9	Modulator	4 - 6	300

TABLE 7
CIRCUIT BREAKER RATINGS

		Amperes		
Symbol	Function	Operating Current	Measured Current	Breaking Current
B-1	A-c Line	4.6	4.4	5.75
B-2	A-c Line	4.6	4.4	5.75
B-3	Filament	1.6	1.4	2.0
B-4	Plate	2.6	2.5	3.0

E. APPENDIX
RADIO TRANSMITTER BC-400-B, BC-400-C, BC-400-D, BC-400-E
TABLE OF REPLACEMENT PARTS

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
R-1	Resistor, Relay Dropping	12,500 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-631022-E	
R-2	Resistor, Audio Osc. Grid	1000 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-3	Resistor, Audio Osc. Cathode	3000 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-4	Resistor, Driver Cathode	500 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-5	Volume Control, Modulator	500,000 ohms	Clarostat	No. 370 R.R. No. A-152-86	
R-6	Resistor, a-f, H.V. Bleeder	9,400 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-E	
R-7	Resistor, r-f, H.V. Bleeder	9,000 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-E	
R-8	Resistor, 2nd & 3rd Mult. Screen	17,500 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-E	
R-9	Resistor, 3rd Mult. Plate Dropping	2,500 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-63080-E	
R-10	Resistor, Mod. Indicator Mult.	50,000 ohms, 2 watts	I. R. C.	BT-2	
R-11	Resistor, 1st Mult. Plate Dropping	5,000 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-63085-E	
R-12	Resistor, 2nd Mult. Plate Dropping	3,000 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-63081-E	
R-13	Resistor, P.A. Screen Dropping	10,000 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-63090-E	
R-14	Resistor, P.A. Plate Dropping	1,500 ohms, 60 watts Navy Style "D"	Ward-Leonard	CAO-63078-E	
R-15	Resistor, P.A. Control Grid	20,000 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-16	Resistor, 3rd Mult. Grid	50,000 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-17	Resistor, Osc. Grid	200,000 ohms, 2 watts ± 10%	I. R. C.	BT-2	

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
R-18	Resistor, Osc. Screen	35,000 ohms, 3 watts ± 10%	I. R. C.	F-3	
R-19	Resistor, Mult. Grid	20,000 ohms, 3 watts ± 10%	I. R. C.	F-3	
R-20	Resistor, Mult. Cathode	500 ohms, 2 watts ± 10%	I. R. C.	BT-2	
R-21	Potentiometer, Mod. Indicator	100,000 ohms, "S" taper, 2000 v Insul. Bushing	Clarostat	No. 37	
C-1	Condenser, Bias Filter	10 mfd, 600 v d-c (working) oil paper ± 10%	Solar	XLUC-6-10	
C-2	Condenser, Power Supply Filter	10 mfd., 600 v d-c (working) oil paper ± 10%	Solar	XLUC-6-10	
C-3	Condenser, Power	10 mfd., 600 v d-c (working) oil paper ± 10%	Solar	XLUC-6-10	
C-4 & C-5 (Matched pair)	Condenser, Audio Osc. Plate Tuning	.035 ± 5% mfd. total capacity (.01 & .025) 1200 v Test, Mica	Solar	XQB	
C-6	Condenser, r-f Plate Meter Bypass	.005 ± 5% mfd. 1000 v. Test; ± 20%, Mica	Solar	MW	
C-7	Condenser, a-f Plate Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-8	Condenser, 3rd Mult. Grid Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-9	Condenser, 3rd Mult. Plate Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-10	Condenser, Modulation Indicator Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-11	Condenser, Osc. Plate Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-12	Condenser, 2nd Mult. Plate Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-13	Condenser, P. A. Grid Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	

Par. E Cont.

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
C-14	Condenser, P. A. Plate Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	
C-15	Condenser, Crystal Osc. Cathode Tuning	100 mmfd. Mica 2000 v Test; ± 20%	Solar	MHB-1016	
C-16	Condenser, Crystal Osc. Screen Bypass	.0015 mfd., 600 v d-c Mica ± 20%, 1200 v Test	Solar	MHB-1029	
C-17	Tuning Capacitor Oscillator Plate	Dual Capacitor 35 mmfd. per section	Cardwell	ER-35-AD	
C-18	Condenser, Crystal Osc. Plate Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-19	Condenser, 2nd Mult. Grid Coupling	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-20	Condenser, 2nd Mult. Screen Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-21	Condenser, 2nd Mult. Cathode Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-22	Tuning Capacitor 2nd Mult. Plate	Dual Capacitor 35 mmfd. per section	Cardwell	ER-35-AD	
C-23	Condenser, 2nd Mult. Plate Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-24	Tuning Capacitor 3rd Mult. Grid	Dual Capacitor 35 mmfd. per section	Cardwell	ER-35-AD	
C-25	Condenser, 3rd Mult. Screen Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-26	Condenser, P.A. Plate Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-27	Tuning Capacitor 3rd Mult. Plate	Dual Capacitor 15 mmfd. per section	Cardwell	ET-15-AD	
C-28	Tuning Capacitor Power Amp. Grid	Dual Capacitor 15 mmfd. per section	Cardwell	ET-15-AD	
C-29	Condenser, P.A. Screen Bypass	.0015 mfd., 600 v d-c Mica ± 20% 1200 v Test	Solar	MHB-1029	
C-30	Tuning Capacitor Power Amp. Plate	Dual Capacitor 15 mmfd. per section	Cardwell	ET-15-AD	
C-31	Condenser, Modulator Plate Meter Bypass	.005 ± 5% mfd. Mica 1000 v Test; ± 20%	Solar	MW	

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
C-32	Condenser, Crystal Osc. Feedback	22 mmfd. ± $2\frac{1}{2}$ mmfd.; 600 v (working) Silver Mica Low Loss Type	Solar	MOS-20	
T-1	Transformer, Voltage Regulator	Pri.-95-130 v a-c Sec. 116 v a-c	Thordarson	T-46247	
T-2	Transformer, r-f Audio Filament	Pri. 115 v a-c Sec. 6.3 v 10 amps.	Thordarson	T-46248	
T-3	Transformer, H.V. Rectifier Filament	Pri. Sec. 5 v 6 amps.	Thordarson	T-46249	
T-4	Transformer, r-f H.V., Plate	Pri. Sec. 950 v 275 ma	Thordarson	T-46250	
T-5	Transformer, a-f H.V. Plate	Pri. Sec. 770 v 270 ma	Thordarson	T-46251	
T-6	Transformer, Bias Rectifier Plate	Pri. Sec. 905 v 30 ma	Thordarson	T-46252	
T-7	Transformer, Audio Osc. & Input		Thordarson	T-46253	
T-8	Transformer, a-f Driver		Thordarson	T-46254	
T-9	Transformer, Mod. Output		Thordarson	T-46255	
L-1	Reactor, r-f H.V. Filter	12 H 275 ma	Thordarson	T-46256	
L-2	Reactor, a-f H.V. Filter	12 H 210 ma	Thordarson	T-46257	
L-3	R-f Choke Cathode Crystal Osc.	1 mh.	National	Type R300-U	
M-1	Meter, a-c Line Voltmeter	0-150 volts a-c	Westinghouse	S#1203986 NA-33	
M-2	Meter, r-f Plate Voltmeter	0-500 volts 1000 ohms/volt	Westinghouse	NY-24028-7 NX-33	
M-3	Meter, a-f Plate Voltmeter	0-500 volts 1000 ohms/volt	Westinghouse	NY-24028-7 NX-33	
M-4	Meter, 3rd Mult. Grid Milliammeter	0-10 ma	Westinghouse	S#1203512 NX-33	
M-5	Meter, 3rd Mult. Plate Milliammeter	0-100 ma	Westinghouse	S#1203521 NX-33	

Par. E Cont.

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
M-6	Meter, Modulation Indicator	0-100 special scale 1 milliampere movement	Westinghouse	NY-24-28-8 NX-33 R.R. Dwg. A-152-64	
M-7	Meter, Modulator Plate Milliammeter	0-300 ma	Westinghouse	S#1203525 NX-33	
M-8	Meter, Osc. Plate Milliammeter	0-100 ma	Westinghouse	S#1203521 NX-33	
M-9	Meter, 2nd Mult. Plate Milliammeter	0-100 ma	Westinghouse	S#1203521 NX-33	
M-10	Meter, P.A. Grid Milliammeter	0-15 ma	Westinghouse	S#1203513 NX-33	
M-11	Meter, P.A. Plate Milliammeter	0-150 ma	Westinghouse	S#1203522	
B-1	Circuit Breaker A-c Line	4.6 amperes	Heinneman	Type 0411	
B-2	Circuit Breaker A-c Line	4.6 amperes	Heinneman	Type 0411	
B-3	Circuit Breaker Filament Power	1.6 amperes	Heinneman	Type 0411	
B-4	Circuit Breaker Plate Power	2.6 amperes	Heinneman	Type 0411	
RL-1	Relay-Bias Interlock	2.03 volt d-c Coil	Kurman	Type 220C-34L	
RL-2	Relay-Plate Power	48 volt d-c Coil	Leach	Type #1254	
S-1	Switch-Voltage Regulator	D.P.D.T. Flush Tumbler	A.H. & H.	#8660	
S-2	Switch-Voltage Regulator	D.P.D.T. Flush Tumbler	A.H. & H.	#8660	
S-3	Switch-Plate Voltage Control	Tandem Tap Switch	Ohmite	Type 111T2-4 Fig. 137, Cat. 40	
S-4	Switch-Crystal Changeover	2 position-non-shorting D.P.D.T. Wafer Type, Isolantite Insulation	Centralab	Type H-60° Rotation	
S-5	Micro Switch-Crystal Door Safety Interlock	S.P.S.T. Normally Open	Micro-Switch	G-RL2	

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
S-6	Micro Switch-Rear Door Safety Interlock	S.P.S.T. Normally Open	Micro-Switch	G-RL2	
TS-1	Terminal Strip Power Control Unit	6 Terminals 9/16″ Centers	Jones	142-6	
TS-2	Terminal Strip Bias Unit	5 Terminals 9/16″ Centers	Jones	142-5	
TS-3	Terminal Strip Power Supply	5 Terminals 9/16″ Centers	Jones	142-5	
TS-4	Terminal Strip Modulator	5 Terminals 9/16″ Centers	Jones	142-5	
TS-5	Terminal Strip R-f Panel	6 Terminals 9/16″ Centers	Jones	142-6	
TS-6	Terminal Strip Power Control Unit	6 Terminals 9/16″ Centers	Jones	142-6	
TS-7	Terminal Strip Bias Unit	5 Terminals 9/16″ Centers	Jones	142-5	
TS-8	Terminal Strip Power Supply	5 Terminals 9/16″ Centers	Jones	142-5	
TS-9	Terminal Strip Modulator	5 Terminals 9/16″ Centers	Jones	142-5	
TS-10	Terminal Strip R-f Panel	6 Terminals 9/16″ Centers	Jones	142-6	
TS-11	Terminal Block A-c Input	2 Terminals without cover	Burke	6002-H	
V-1	Tube Socket 6L6 Crystal Osc.	8 prong	National	CIR-8	
V-2	Tube Socket 6L6 2nd Mult.	8 prong	National	CIR-8	
V-3	Tube Socket 815 3rd Mult.	8 prong	National	CIR-8	
V-4	Tube Socket 815 Power Amp.	8 prong	National	CIR-8	
V-5	Tube Socket 6N7 Modulator	8 prong	National	CIR-8	
V-6	Tube Socket 6N7 Modulator	8 prong	National	CIR-8	

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
V-7	Tube Socket 6N7 Driver	8 prong	National	CIR-8	
V-8	Tube Socket 6N7 Driver	8 prong	National	CIR-8	
V-9	Tube Socket 6F6 Audio Osc.	8 prong	National	CIR-8	
V-10	Tube Socket 84 Bias Isolator	5 prong	National	CIR-5	
V-11	Tube Socket 84 Bias Rectifier	5 prong	National	CIR-5	
V-12	Tube Socket 5Z3 A-f Plate Rectifier	4 prong	National	CIR-4	
V-13	Tube Socket 5Z3 A-f Plate Rectifier	4 prong	National	CIR-4	
V-14	Tube Socket 5Z3 R-f Plate Rectifier	4 prong	National	CIR-4	
V-15	Tube Socket 5Z3 R-f Plate Rectifier	4 prong	National	CIR-4	
V-16	Tube Socket 84 Mod. Indicator Rectifier	5 prong	National	CIR-5	
P-1 Male	Connector—Rear Door Interlock	2 prong—male	Jones	P-302-CCT	
P-1 Female	Connector—Rear Door Interlock	2 prong—female	Jones	S-302-AB	
I-1	Pilot Lamp—plate	110 volts, 6 watts	Hygrade	S-6 clear	
I-2	Pilot Lamp—filament	110 volts, 6 watts	Hygrade	S-6 clear	
I-3	Pilot Lamp—A-c line	110 volts, 6 watts	Hygrade	S-6 clear	
FT-164-1	Crystal Frequency Control	4166.67 KC	Bliley		
FT-164-2	Crystal Frequency Control	4166.67 KC	Bliley		

Symbol	Name or Function	Description	Manufacturer	Identification	Notes
		List of Vacuum Tubes			
V-1	Crystal Osc.	6L6, U.S. Type VT-115	RCA		
V-2	2nd Mult.	6L6, U.S. Type VT-115	RCA		
V-3	3rd Mult.	815, Comm. Type 815	RCA		
V-4	Power Amp.	815, Comm. Type 815	RCA		
V-5	Modulator	6N7, U.S. Type VT-96	RCA		
V-6	Modulator	6N7, U.S. Type VT-96	RCA		
V-7	Driver	6N7, U.S. Type VT-96	RCA		
V-8	Driver	6N7, U.S. Type VT-96	RCA		
V-9	Audio Oscillator	6F6, U.S. Type VT-66	RCA		
V-10	Bias Isolator	84, U.S. Type VT-84	RCA		
V-11	Bias Rectifier	84, U.S. Type VT-84	RCA		
V-12	A-f Plate Rect.	5Z3, U.S. Type VT-145	RCA		
V-13	A-f Plate Rect.	5Z3, U.S. Type VT-145	RCA		
V-14	R-f Plate Rect.	5Z3, U.S. Type VT-145	RCA		
V-15	R-f Plate Rect.	5Z3, U.S. Type VT-145	RCA		
V-16	Mod. Ind.	84, U.S. Type VT-84	RCA		

LIST OF SPARE PARTS

Quan.	Symbol	Identification
1	R-2	I.R.C. Type BT-2, 1000 ohms Resistor
1	R-3	I.R.C. Type BT-2, 3000 ohms Resistor
1	R-4, R-20	I.R.C. Type BT-2, 500 ohms Resistor
1	R-15	I.R.C. Type BT-2, 20,000 ohms Resistor
1	R-10, R-16	I.R.C. Type BT-2, 50,000 ohms Resistor
1	R-17	I.R.C. Type BT-2, 200,000 ohms Resistor
1	R-18	I.R.C. Type BT-2, 35,000 ohms Resistor
1	R-19	I.R.C. Type F-3, 20,000 ohms Resistor
1	R-9	Ward-Leonard Type CAO-6308E, 2,500 ohms Resistor
1	R-8	Ward-Leonard Type CAO-E, 17,500 ohms Resistor
1	R-7	Ward-Leonard Type CAO-E, 9,000 ohms Resistor
1	R-6	Ward-Leonard Type CAO-E, 9,400 ohms Resistor
1	R-14	Ward-Leonard Type CAO-63078E, 1,500 ohms Resistor
1	R-13	Ward-Leonard Type CAO-63090E, 10,000 ohms Resistor
1	R-12	Ward-Leonard Type CAO-63081E, 3,000 ohms Resistor
1	R-11	Ward-Leonard Type CAO-63085E, 5,000 ohms Resistor
1	R-1	Ward-Leonard Type CAO-631022E, 12,500 ohms Resistor
1	R-21	Clarostat Type 37 Taper Special, 100,000 ohms Potentiometer
1	R-5	Clarostat Type 37D Dual, 500,000 ohms Potentiometer
2	C-1, C-2, C-3	Solar Type XLUC 10 mfd. Condenser
1	C-4, C-5	Solar Type XQB Matched Pair .035 mfd. Mica Condenser
5	C-16, C-18, C-19, C-20, C-21, C-23, C-25, C-26, C-29	Solar Type MHB-1029, .0015 mfd. Mica Condenser
1	C-15	Solar Type MHB-1016, .0001 mfd. Mica Condenser
1	C-32	Solar Type MO, .000022 mfd. Mica Condenser
5	C-6, C-7, C-8, C-9, C-10, C-11, C-12, C-13, C-14, C-31	Solar Type MW, .005 mfd. Mica Condenser
1	M-5, M-8, M-9	Westinghouse Type s#1203521 NX33 0-100 Ma. D-c Meter
1	M-11	Westinghouse Type s#1203522 NX33 0-150 Ma. D-C Meter
1	M-7	Westinghouse Type s#1203525 NX33 0-300 Ma. D-c Meter
1	M-10	Westinghouse Type s#1203513 NX33 0-15 Ma. D-C Meter
1	M-4	Westinghouse Type s#1203512 NX33 0-10 Ma. D-c Meter

Quan.	Symbol	Identification
1	M-2, M-3	Westinghouse Type s#1203845 NX33 0-500 V. D-c Meter
1	M-6	Westinghouse Type s#1203503 NX33 0-1 Ma. D-c Meter
1	M-1	Westinghouse Type s#1203986 NA33 0-150 V. A-c Meter
1	RL-1	Kurman Type #34 Coil
2 (sets)	RL-1	Kurman Type 220 C 34 L Contacts
1	RL-2	Leach Type #359 Coil
2 (sets)	RL-2	Leach Type #1254 Contacts
2	V-3, V-4	RCA Type 815, Comm.
2	V-1, V-2	RCA Type 6L6, U.S. Type VT-115 Tube
1	V-9	RCA Type 6F6, U.S. Type VT-66 Tube
4	V-5, V-6, V-7, V-8	RCA Type 6N7, U.S. Type VT-96 Tube
4	V-12, V-13, V-14, V-15	RCA Type 5Z3, U.S. Type VT-145 Tube
3	V-10, V-11, V-16	RCA Type 84, U.S. Type VT-84 Tube
18	I-1, I-2, I-3	Hygrade Type S-6 Pilot Bulb

LIST OF MANUFACTURERS

Name	Address
Arrow-Hart & Hegeman Electric Co.	103 Hawthorne St., Hartford, Conn.
Burke Electric Company	Erie, Pa.
Allen D. Cardwell Mfg. Co.	81 Prospect St., Brooklyn, N. Y.
Centralab, Inc.	900 E. Keefe Ave., Milwaukee, Wis.
Clarostat Mfg. Company	285 N. Sixth St., Brooklyn, N. Y.
Heinneman Circuit Breaker Co.	Jersey City, N. J.
Hygrade Sylvania Corp.	500 Fifth Avenue, New York, N. Y.
International Resistance Co.	2100 Arch St., Philadelphia, Pa.
Howard B. Jones	2300 Wabansia Ave., Chicago, Ill.
Kurman Electric Co., Inc.	241 Lafayette St., New York, N. Y.
Leach Relay Co., Inc.	5915 Avalon Blvd., Los Angeles, Cal.
Micro-Switch Corp.	11 Park Place, New York, N. Y.
National Company	61 Sherman St., Malden, Mass.
Ohmite Mfg. Company	4835 Flournoy St., Chicago, Ill.
Solar Mfg. Corp.	Bayonne, N. J.
Thordarson Electric Mfg. Co.	500 W. Huron St., Chicago, Ill.
Ward-Leonard Electric Co.	Mount Vernon, N. Y.
Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.

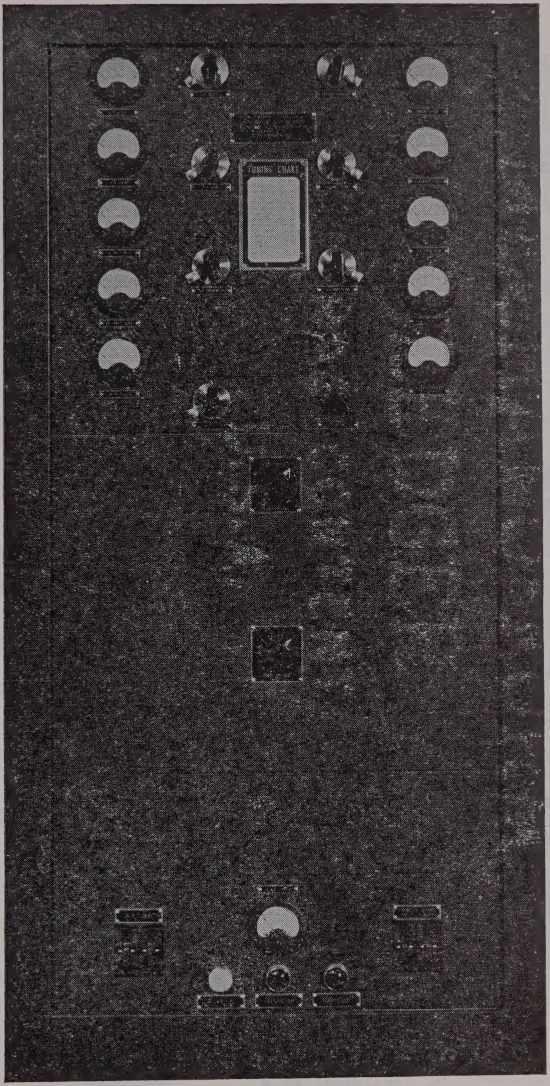

TUNING CHART

Fig. 1

Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Front View

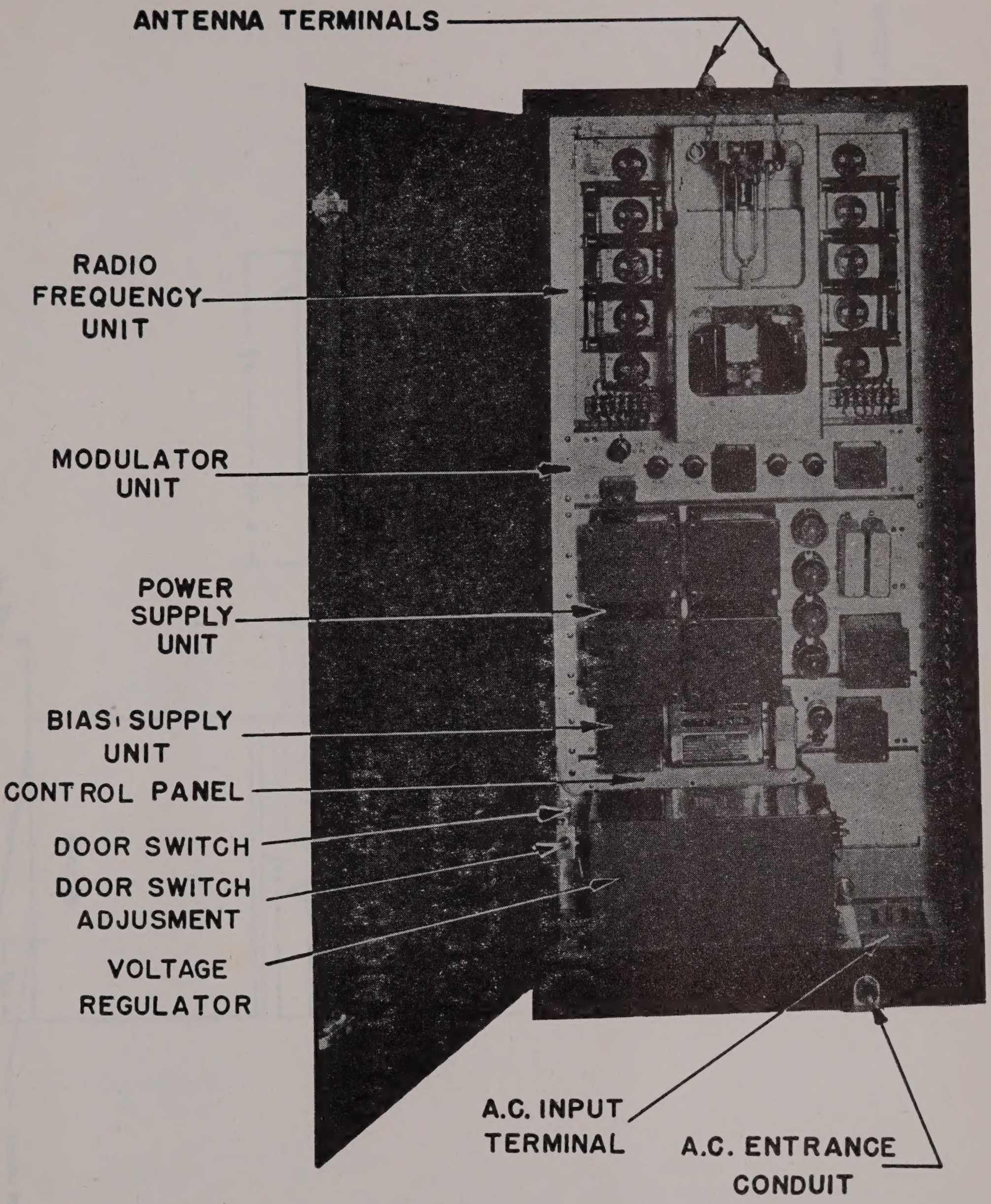

ANTENNA TERMINALS
RADIO FREQUENCY UNIT
MODULATOR UNIT
POWER SUPPLY UNIT
BIAS SUPPLY UNIT
CONTROL PANEL
DOOR SWITCH
DOOR SWITCH ADJUSMENT
VOLTAGE REGULATOR
A.C. INPUT TERMINAL
A.C. ENTRANCE CONDUIT

FIG. 2
RADIO TRANSMITTER, BC-400B, BC-400-C, BC-400-D, BC-400-E, REAR VIEW

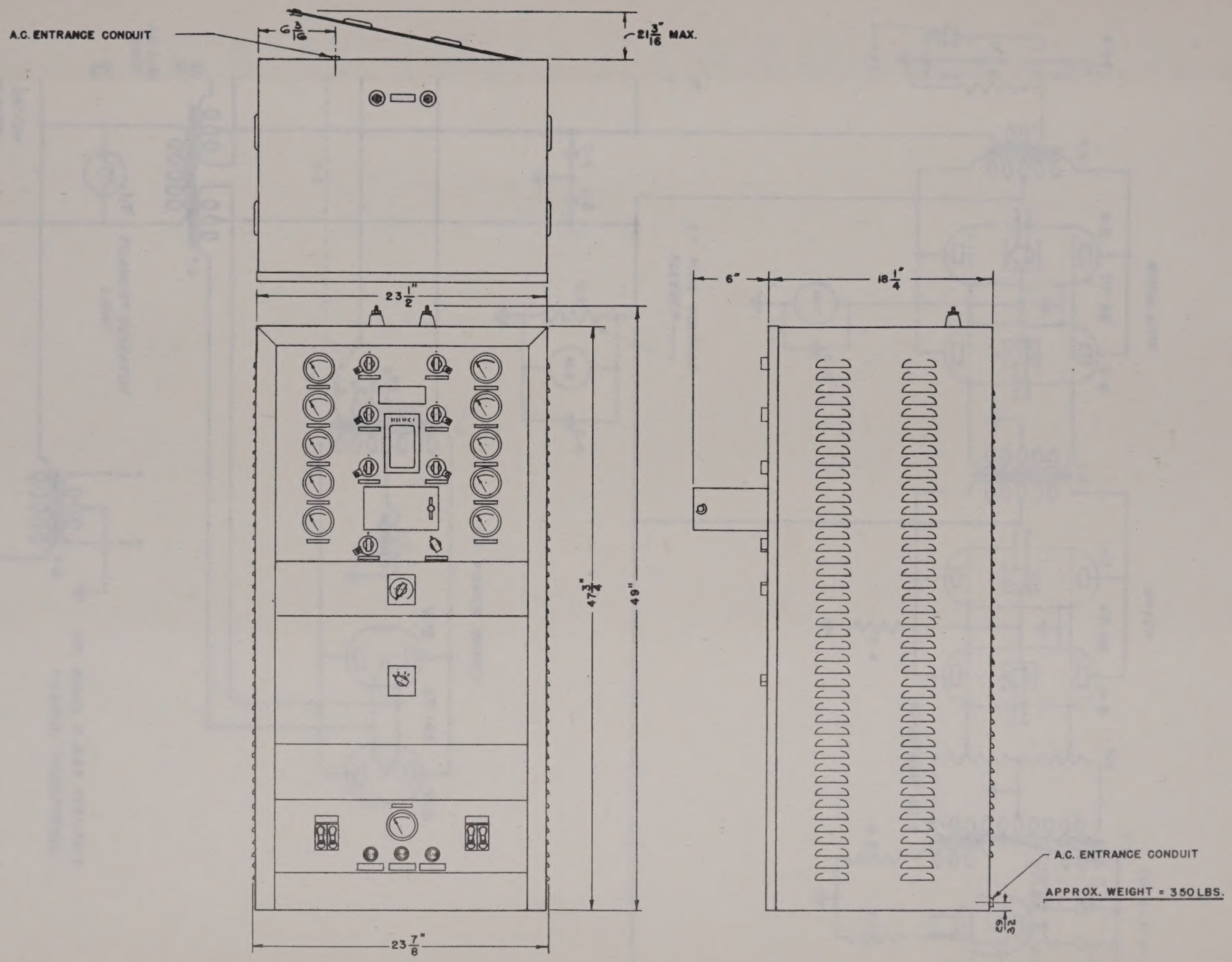

A.C. ENTRANCE CONDUIT
6 3/16
21 3/16" MAX.
23 1/2"
6"
18 1/4"
47 3/4"
49"
23 7/8"
A.C. ENTRANCE CONDUIT
APPROX. WEIGHT = 350 LBS.
2 9/32

Fig. 3 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Outline Drawing

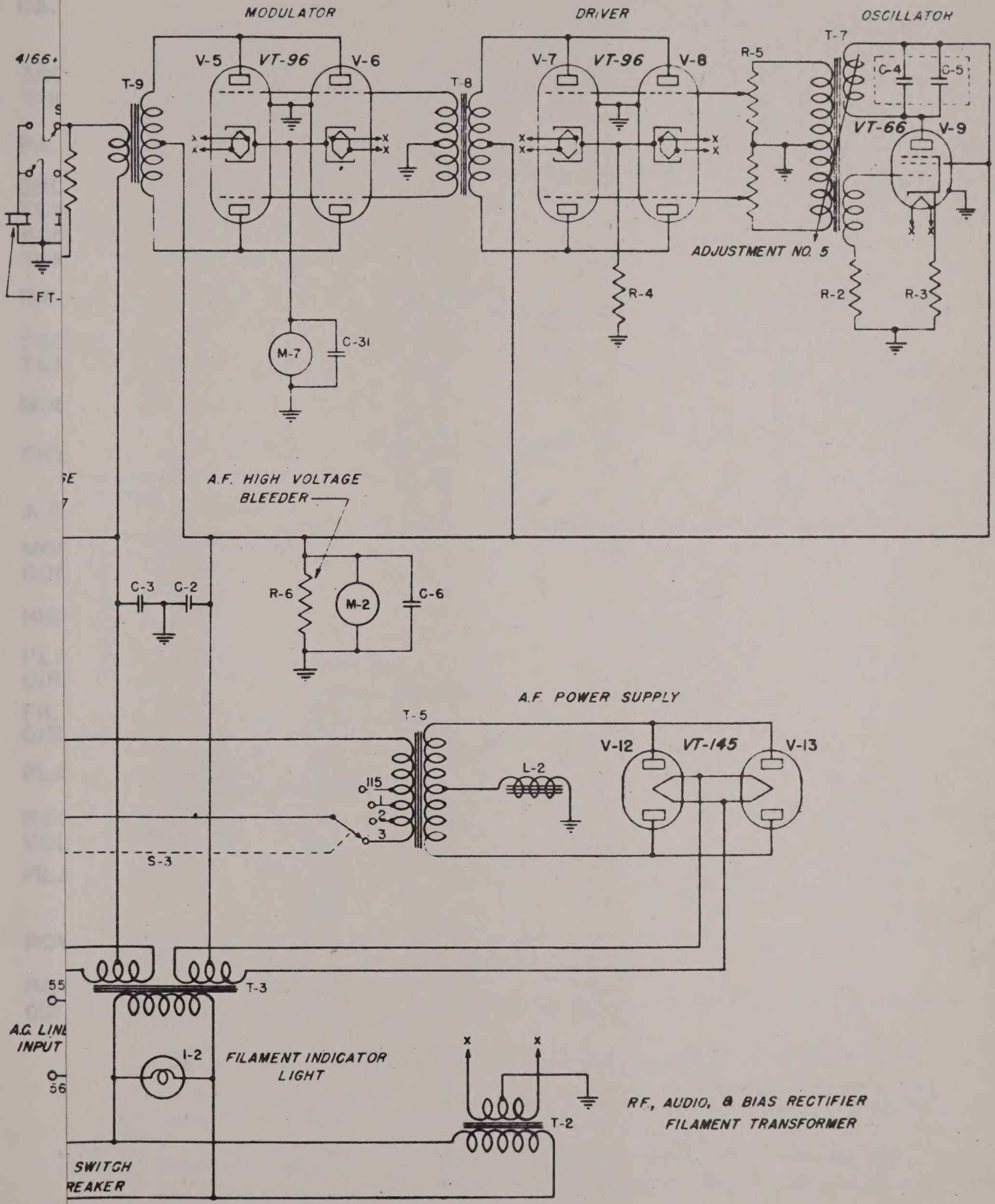

MODULATOR
DRIVER
OSCILLATOR
4166.
T-9
V-5
VT-96
V-6
T-8
V-7
VT-96
V-8
R-5
T-7
C-4
C-5
VT-66
V-9
ADJUSTMENT NO. 5
R-2
R-3
R-4
M-7
C-31
FT-
GE
7
A.F. HIGH VOLTAGE BLEEDER
C-3
C-2
R-6
M-2
C-6
A.F. POWER SUPPLY
T-5
115
1
2
3
L-2
V-12
VT-145
V-13
S-3
55
T-3
A.C. LINE INPUT
56
I-2
FILAMENT INDICATOR LIGHT
X
X
T-2
RF., AUDIO, & BIAS RECTIFIER FILAMENT TRANSFORMER
SWITCH
REAKER

Fig.

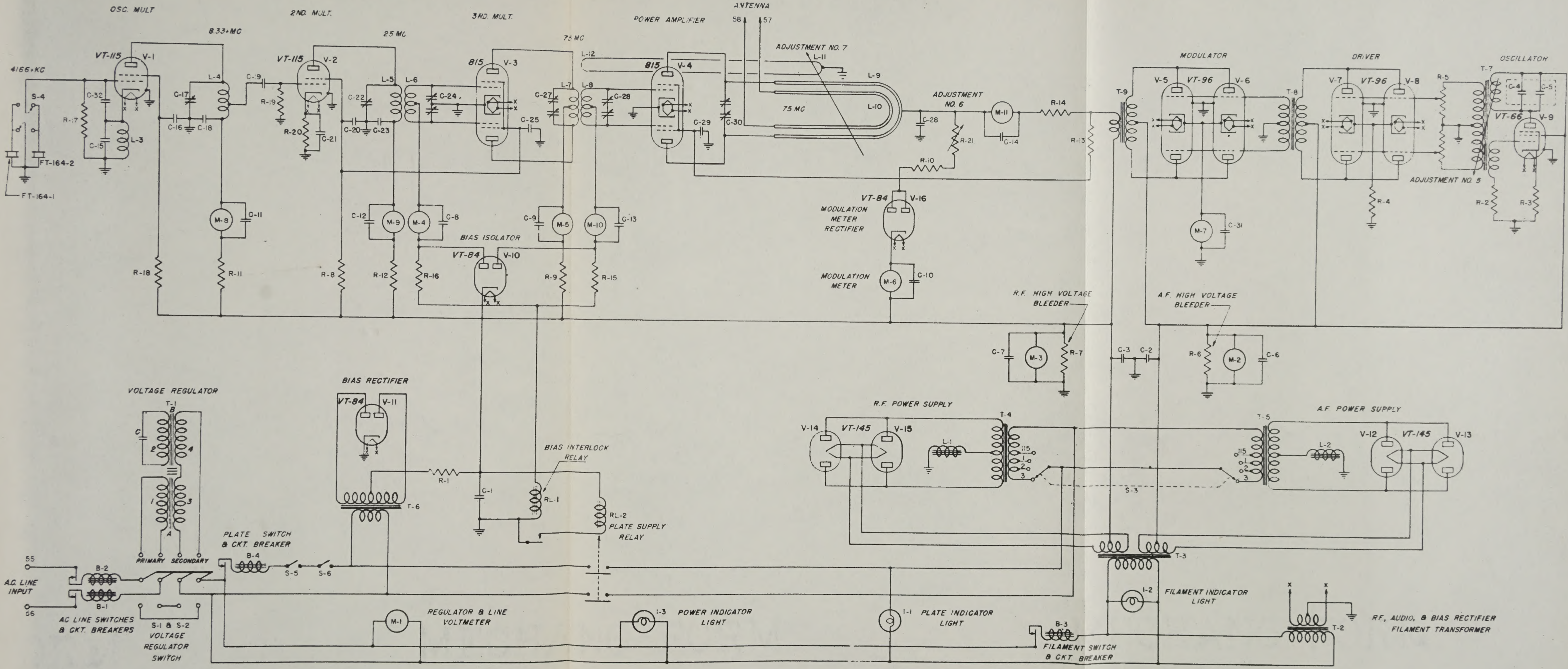

OSC. MULT
2ND. MULT.
3RD. MULT.
POWER AMPLIFIER
ANTENNA
58
57
MODULATOR
DRIVER
OSCILLATOR
4166+KC
8.33+MC
25 MC
75 MC
75 MC
VT-115
V-1
VT-115
V-2
815
V-3
815
V-4
S-4
FT-164-2
FT-164-1
R-17
C-32
C-15
L-3
C-17
L-4
C-16
C-18
C-19
R-19
R-20
C-21
C-22
L-5
L-6
C-20
C-23
C-24
C-25
C-27
L-7
L-8
C-28
L-12
C-29
C-30
ADJUSTMENT NO. 7
L-11
L-9
L-10
ADJUSTMENT NO. 6
C-28
R-21
M-11
C-14
R-14
R-13
R-10
T-9
V-5
VT-96
V-6
T-8
V-7
VT-96
V-8
R-5
T-7
C-4
C-5
VT-66
V-9
ADJUSTMENT NO. 5
R-4
R-2
R-3
M-7
C-31
M-8
C-11
C-12
M-9
M-4
C-8
C-9
M-5
M-10
C-13
BIAS ISOLATOR
VT-84
V-10
R-18
R-11
R-8
R-12
R-16
R-9
R-15
VT-84
V-16
MODULATION METER RECTIFIER
MODULATION METER
M-6
C-10
R.F. HIGH VOLTAGE BLEEDER
A.F. HIGH VOLTAGE BLEEDER
C-7
M-3
R-7
C-3
C-2
R-6
M-2
C-6
VOLTAGE REGULATOR
T-1
B
C
2
4
1
3
A
PRIMARY
SECONDARY
BIAS RECTIFIER
VT-84
V-11
T-6
R-1
C-1
BIAS INTERLOCK RELAY
RL-1
RL-2
PLATE SUPPLY RELAY
R.F. POWER SUPPLY
V-14
VT-145
V-15
L-1
T-4
115
1
2
3
S-3
A.F. POWER SUPPLY
T-5
L-2
V-12
VT-145
V-13
T-3
55
56
A.C. LINE INPUT
B-2
B-1
AC LINE SWITCHES & CKT. BREAKERS
S-1 & S-2 VOLTAGE REGULATOR SWITCH
PLATE SWITCH & CKT. BREAKER
B-4
S-5
S-6
M-1
REGULATOR & LINE VOLTMETER
I-3
POWER INDICATOR LIGHT
I-1
PLATE INDICATOR LIGHT
B-3
FILAMENT SWITCH & CKT. BREAKER
I-2
FILAMENT INDICATOR LIGHT
T-2
RF, AUDIO, & BIAS RECTIFIER FILAMENT TRANSFORMER

Fig. 4 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Schematic Diagram (Functional)

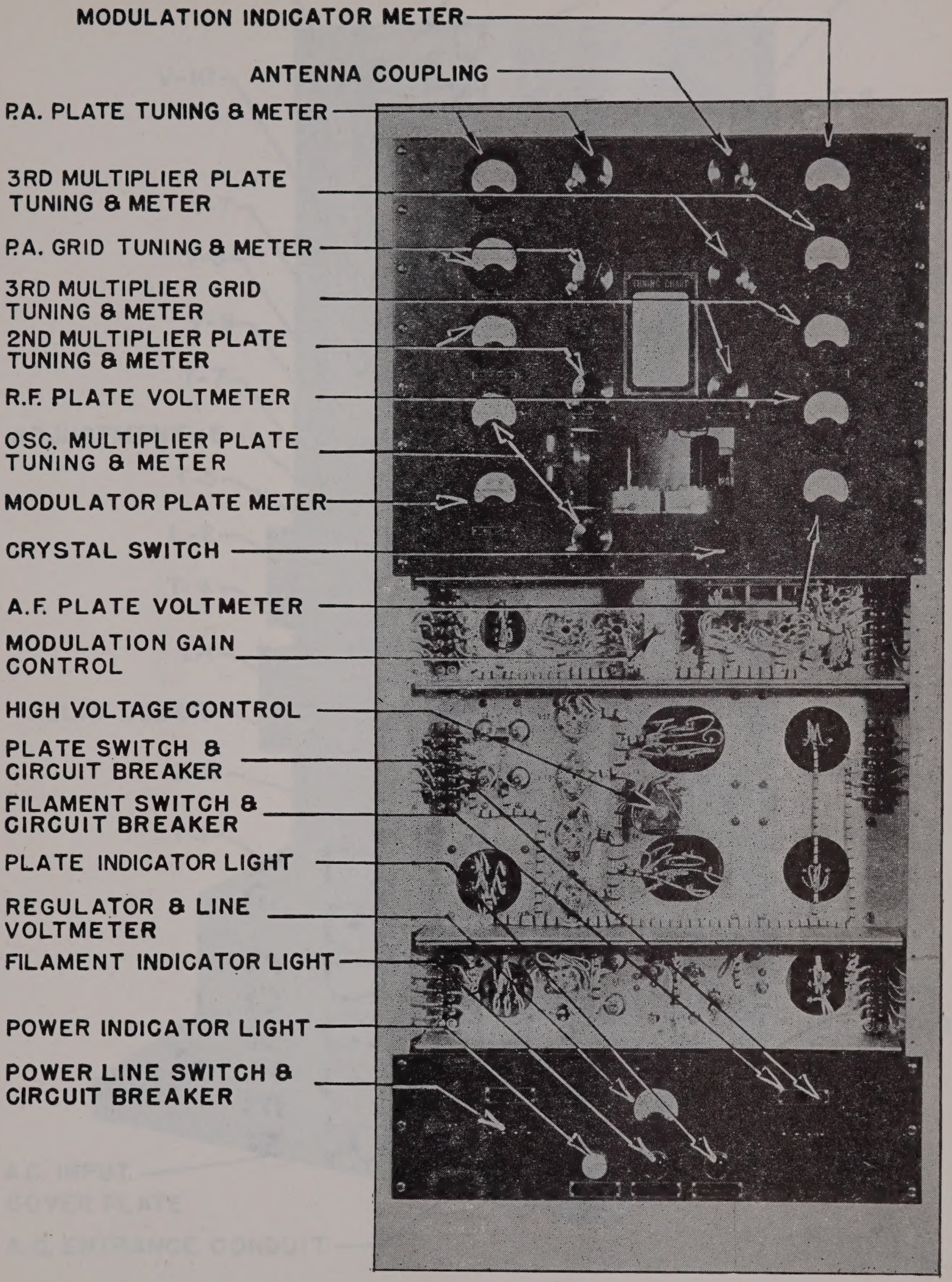

MODULATION INDICATOR METER
ANTENNA COUPLING
P.A. PLATE TUNING & METER
3RD MULTIPLIER PLATE TUNING & METER
P.A. GRID TUNING & METER
3RD MULTIPLIER GRID TUNING & METER
2ND MULTIPLIER PLATE TUNING & METER
R.F. PLATE VOLTMETER
OSC. MULTIPLIER PLATE TUNING & METER
MODULATOR PLATE METER
CRYSTAL SWITCH
A.F. PLATE VOLTMETER
MODULATION GAIN CONTROL
HIGH VOLTAGE CONTROL
PLATE SWITCH & CIRCUIT BREAKER
FILAMENT SWITCH & CIRCUIT BREAKER
PLATE INDICATOR LIGHT
REGULATOR & LINE VOLTMETER
FILAMENT INDICATOR LIGHT
POWER INDICATOR LIGHT
POWER LINE SWITCH & CIRCUIT BREAKER
TUNING CHART

Fig. 5
Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Front View
Cabinet and Panels

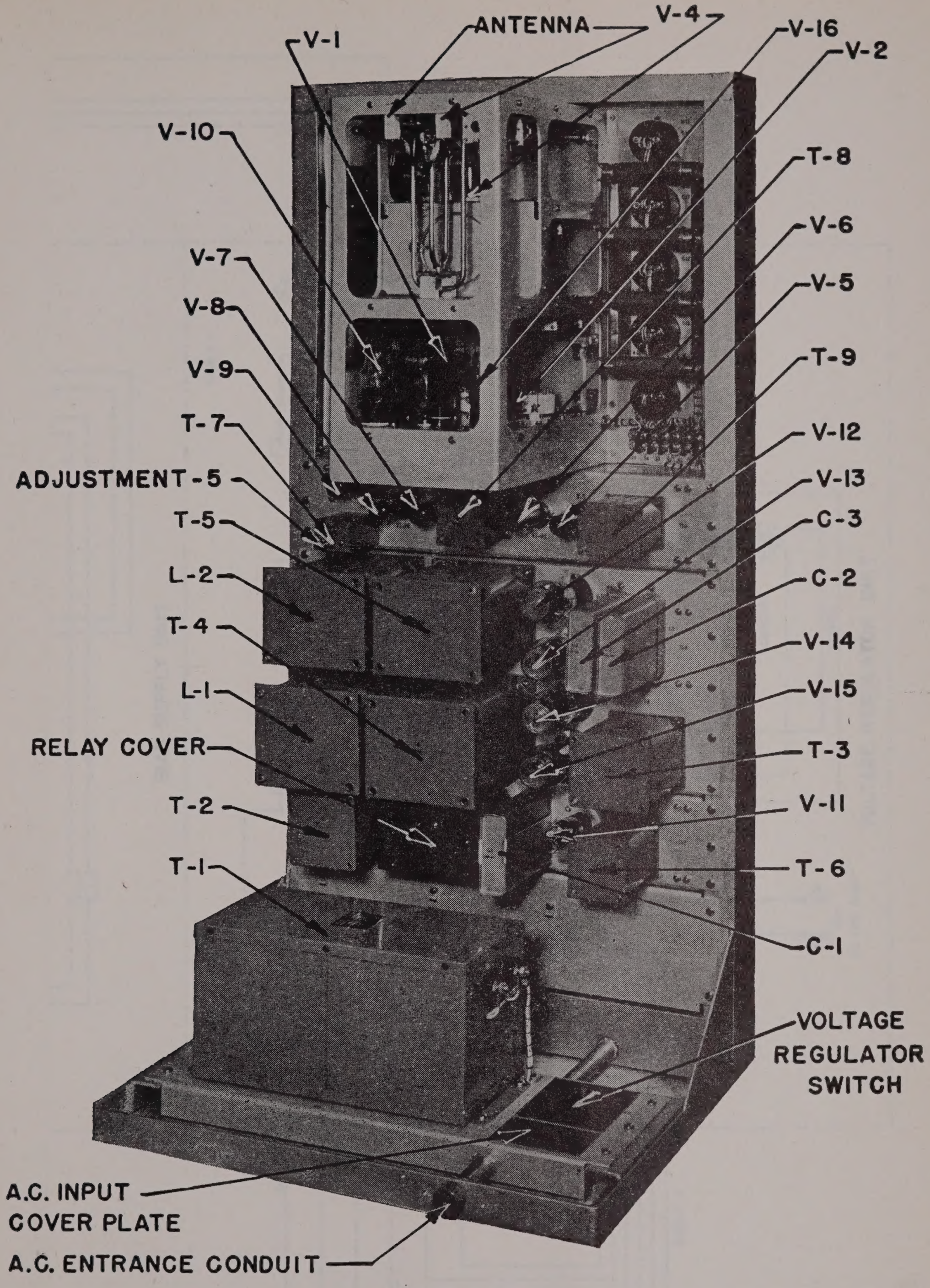
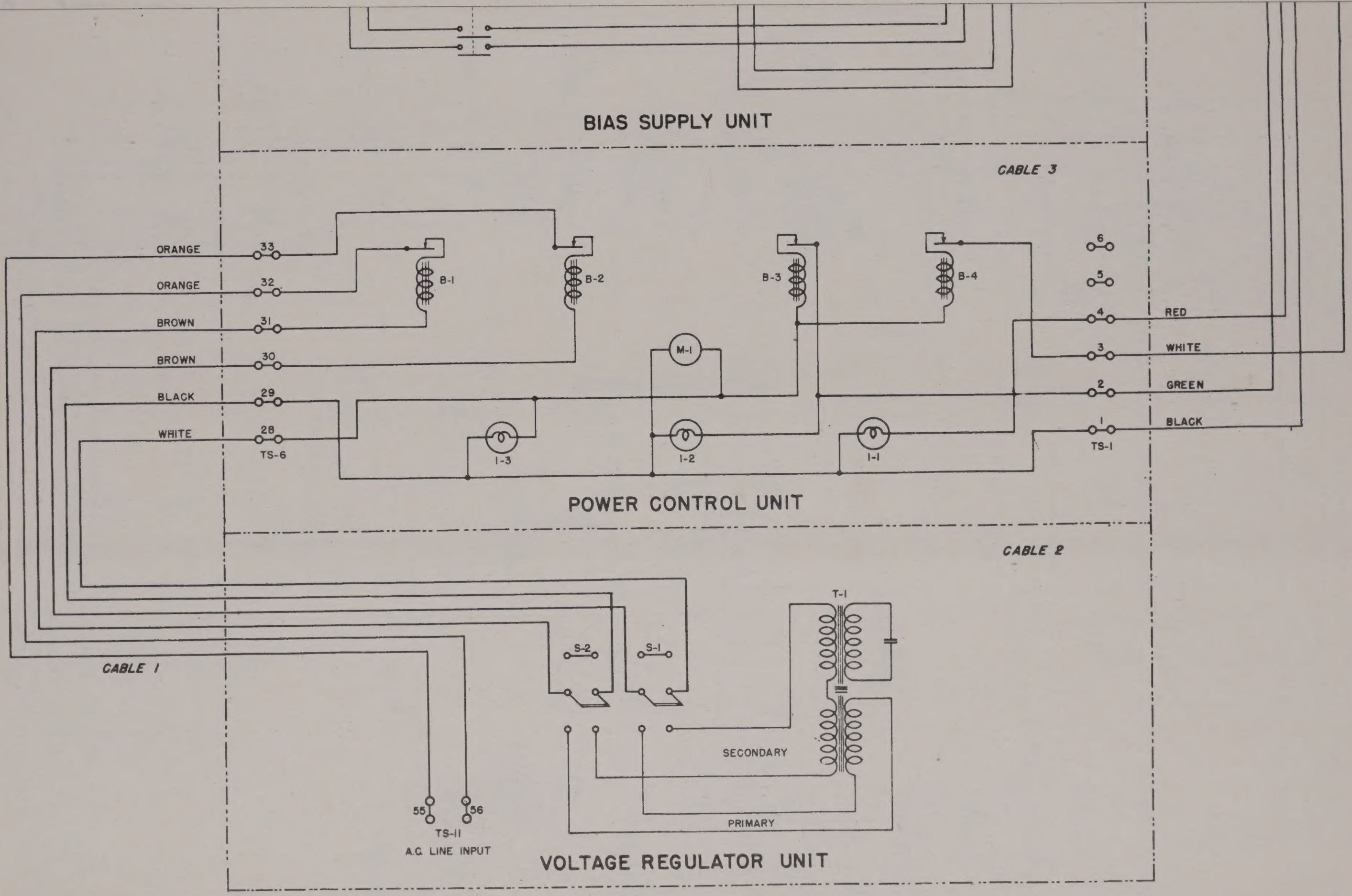
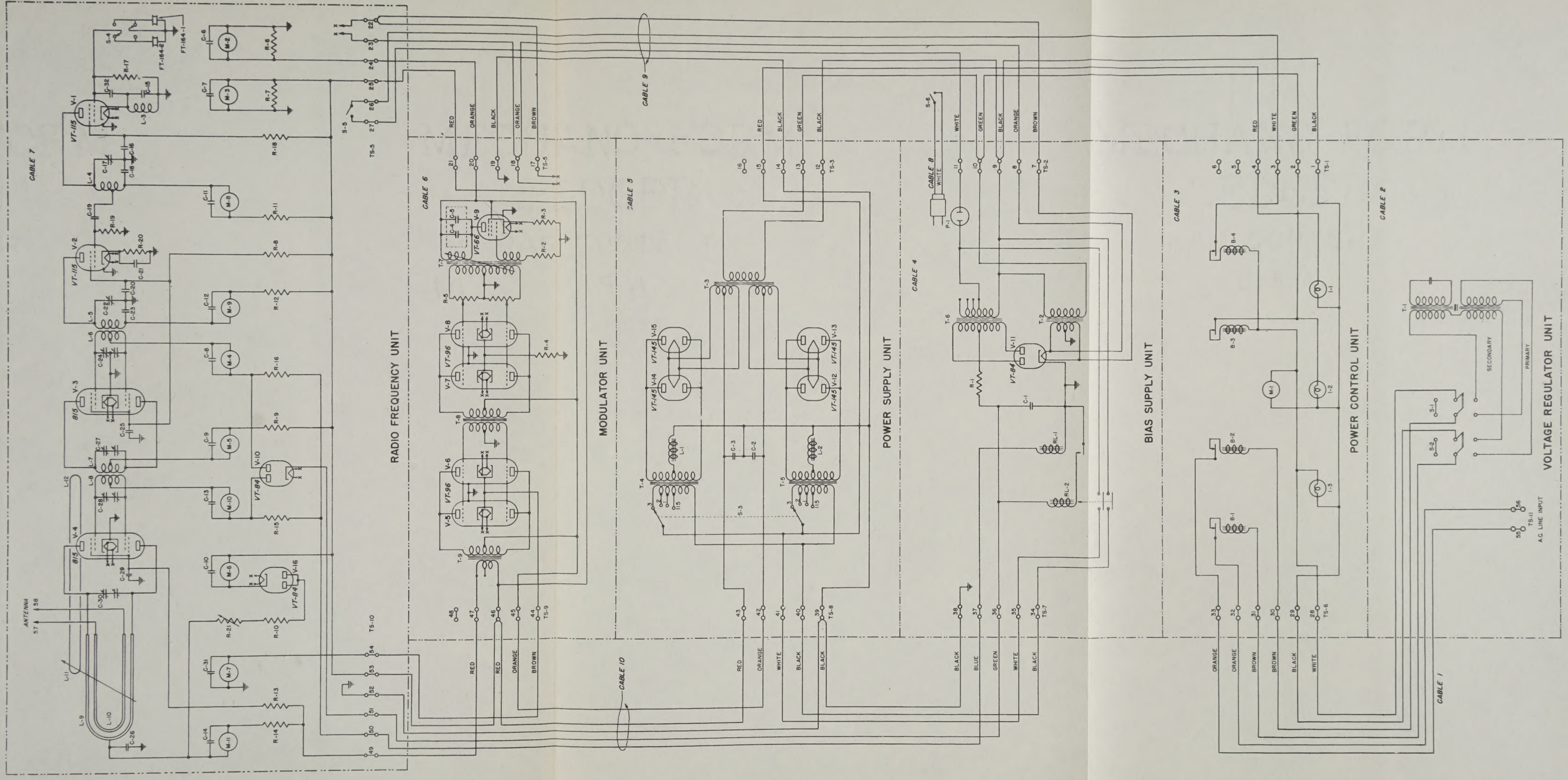

V-1
ANTENNA
V-4
V-16
V-2
V-10
T-8
V-6
V-7
V-8
V-5
V-9
T-9
T-7
V-12
ADJUSTMENT-5
V-13
T-5
C-3
L-2
C-2
T-4
V-14
L-1
V-15
RELAY COVER
T-3
T-2
V-11
T-1
T-6
C-1
VOLTAGE REGULATOR SWITCH
A.C. INPUT COVER PLATE
A.C. ENTRANCE CONDUIT

Fig. 6
Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Back View
Cabinet Removed



BIAS SUPPLY UNIT
CABLE 3
ORANGE
ORANGE
BROWN
BROWN
BLACK
WHITE
33
32
31
30
29
28
TS-6
B-1
B-2
B-3
B-4
M-1
I-3
I-2
I-1
6
5
4
3
2
1
TS-1
RED
WHITE
GREEN
BLACK
POWER CONTROL UNIT
CABLE 2
CABLE 1
T-1
S-2
S-1
SECONDARY
PRIMARY
55
56
TS-11
A.C. LINE INPUT
VOLTAGE REGULATOR UNIT

Fig. 7 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Schematic Wiring Diagram



RADIO FREQUENCY UNIT
MODULATOR UNIT
POWER SUPPLY UNIT
BIAS SUPPLY UNIT
POWER CONTROL UNIT
VOLTAGE REGULATOR UNIT
CABLE 1
CABLE 2
CABLE 3
CABLE 4
CABLE 5
CABLE 6
CABLE 7
CABLE 8
CABLE 9
CABLE 10
ANTENNA
A.C. LINE INPUT
PRIMARY
SECONDARY
VT-115
VT-84
VT-96
VT-66
VT-145
815
TS-1
TS-2
TS-3
TS-5
TS-6
TS-7
TS-8
TS-9
TS-10
TS-11
FT-164-1
FT-164-2

Fig. 7 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Schematic Wiring Diagram

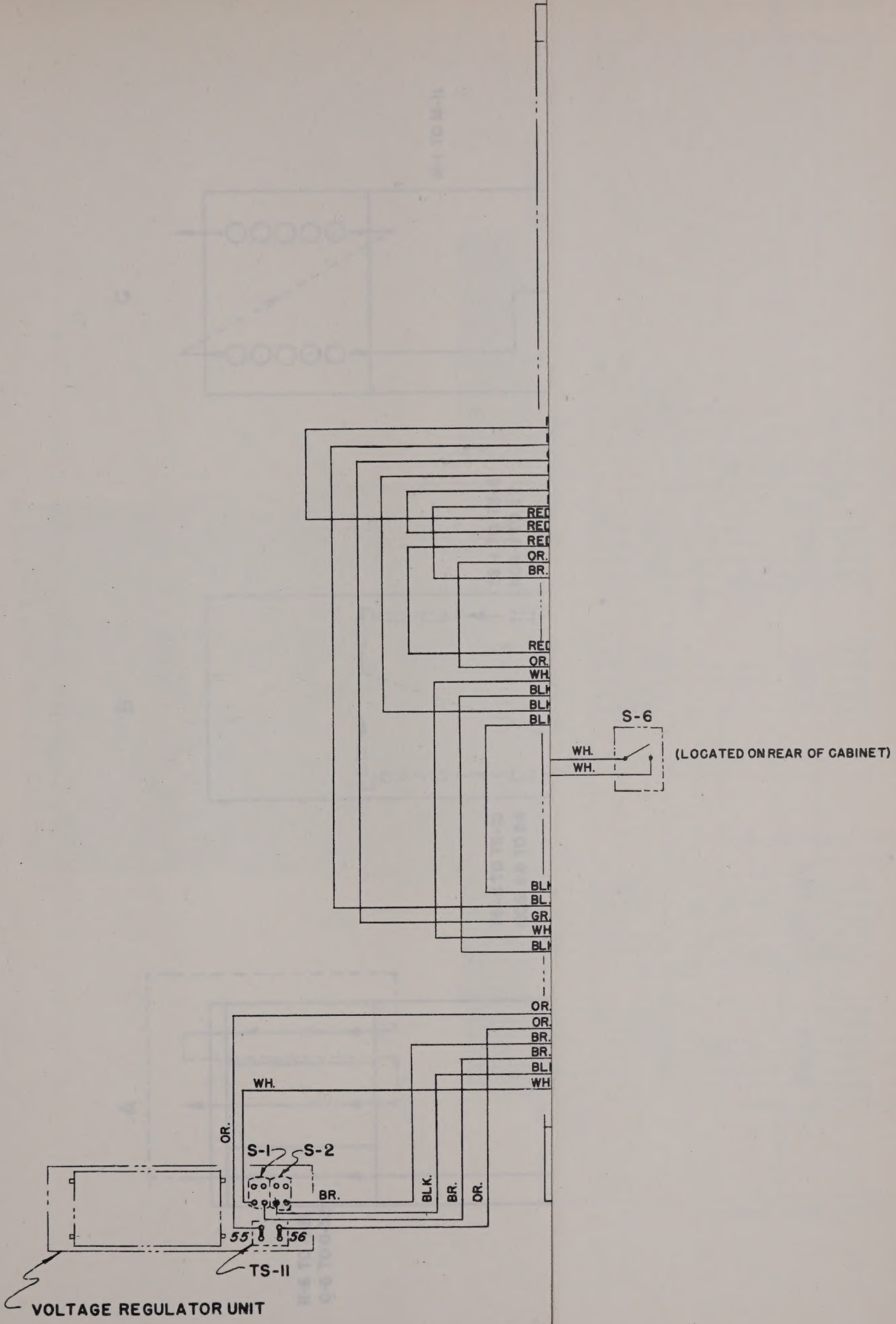

RE
RE
RE
OR.
BR.
RE
OR.
WH.
BL
BL
BL
S-6
WH.
WH.
(LOCATED ON REAR OF CABINET)
BL
BL.
GR.
WH
BL
OR.
OR.
BR.
BR.
BL
WH
WH.
OR.
S-1
S-2
BR.
BLK.
BR.
OR.
55
56
TS-11
VOLTAGE REGULATOR UNIT

Fig. 8 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, B

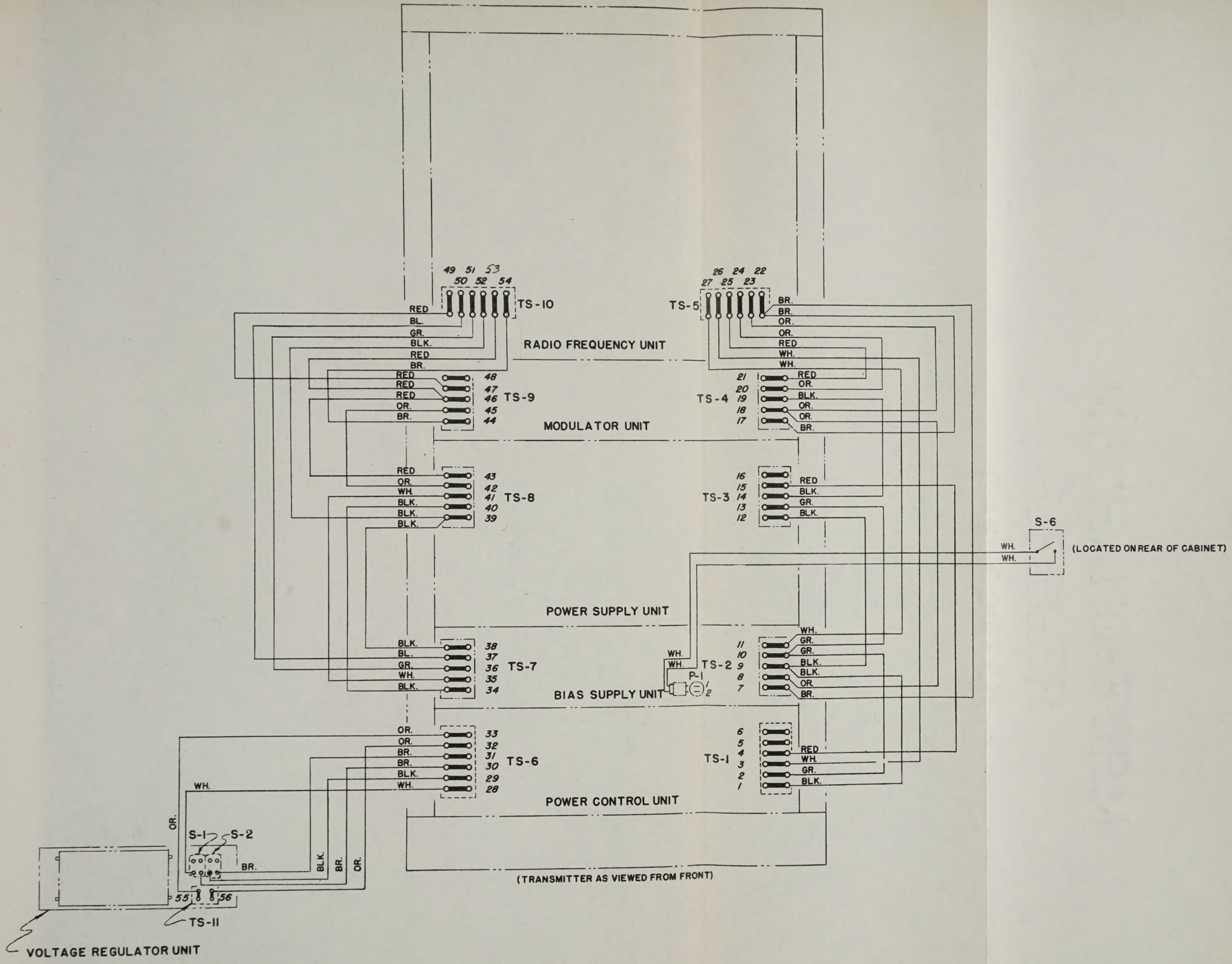

49 51 53
50 52 54
TS-10
26 24 22
27 25 23
TS-5
RED
BL.
GR.
BLK.
RED
BR.
BR.
BR.
OR.
OR.
RED
WH.
WH.
RADIO FREQUENCY UNIT
48
47
46
45
44
TS-9
RED
RED
RED
OR.
BR.
21
20
19
18
17
TS-4
RED
OR.
BLK.
OR.
OR.
BR.
MODULATOR UNIT
RED
OR.
WH.
BLK.
BLK.
BLK.
43
42
41
40
39
TS-8
16
15
14
13
12
TS-3
RED
BLK.
GR.
BLK.
S-6
WH.
WH.
(LOCATED ON REAR OF CABINET)
POWER SUPPLY UNIT
BLK.
BL.
GR.
WH.
BLK.
38
37
36
35
34
TS-7
WH.
WH.
TS-2
P-1
1
2
11
10
9
8
7
WH.
GR.
GR.
BLK.
BLK.
OR.
BR.
BIAS SUPPLY UNIT
OR.
OR.
BR.
BR.
BLK.
WH.
33
32
31
30
29
28
TS-6
6
5
4
3
2
1
TS-1
RED
WH.
GR.
BLK.
WH.
POWER CONTROL UNIT
OR.
S-1
S-2
BR.
BLK.
BR.
OR.
55
56
TS-II
(TRANSMITTER AS VIEWED FROM FRONT)
VOLTAGE REGULATOR UNIT

Fig. 8 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E. Interconnection Wiring Diagram

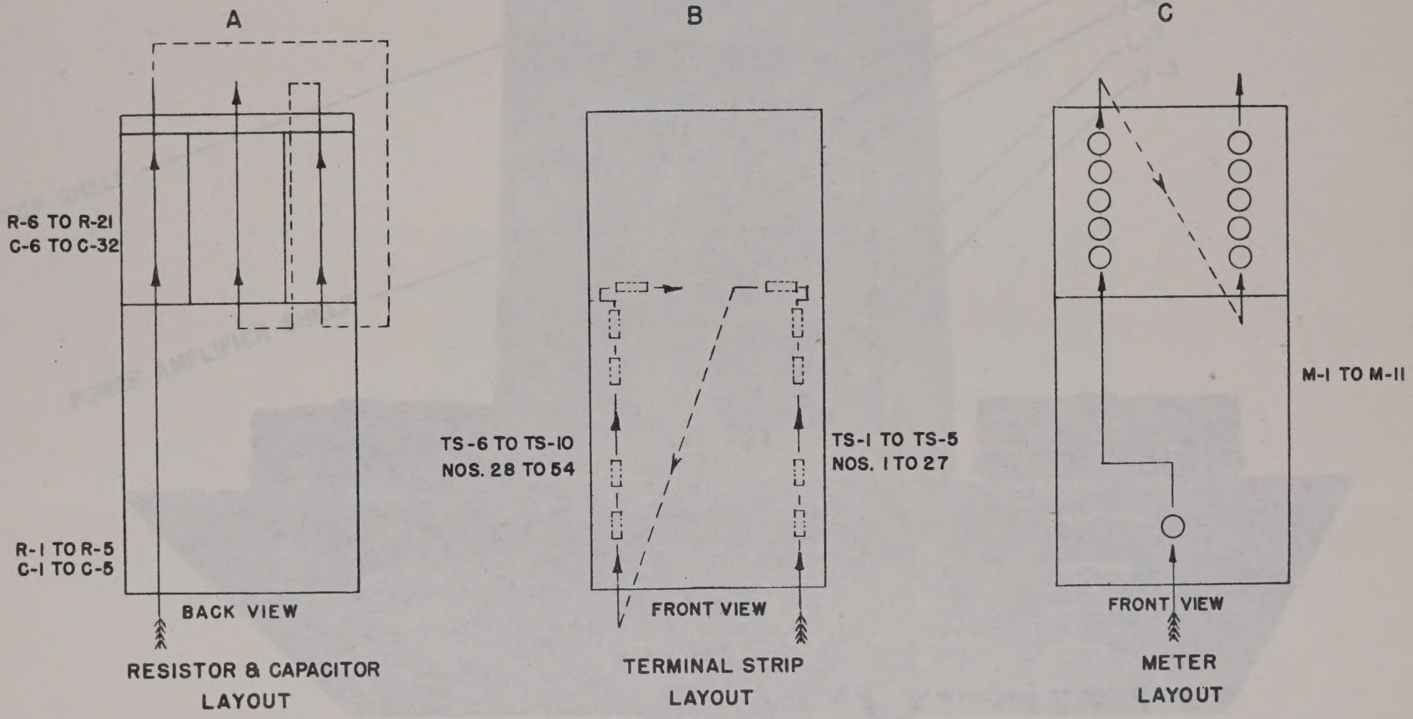

A
B
C
R-6 TO R-21
C-6 TO C-32
R-1 TO R-5
C-1 TO C-5
BACK VIEW
RESISTOR & CAPACITOR LAYOUT
TS-6 TO TS-10
NOS. 28 TO 54
TS-1 TO TS-5
NOS. 1 TO 27
FRONT VIEW
TERMINAL STRIP LAYOUT
M-1 TO M-11
FRONT VIEW
METER LAYOUT

Fig. 9 - Radio Transmitter BC-400-B, BC-400-C, BC-400-D, BC-400-E, Part Number Plan

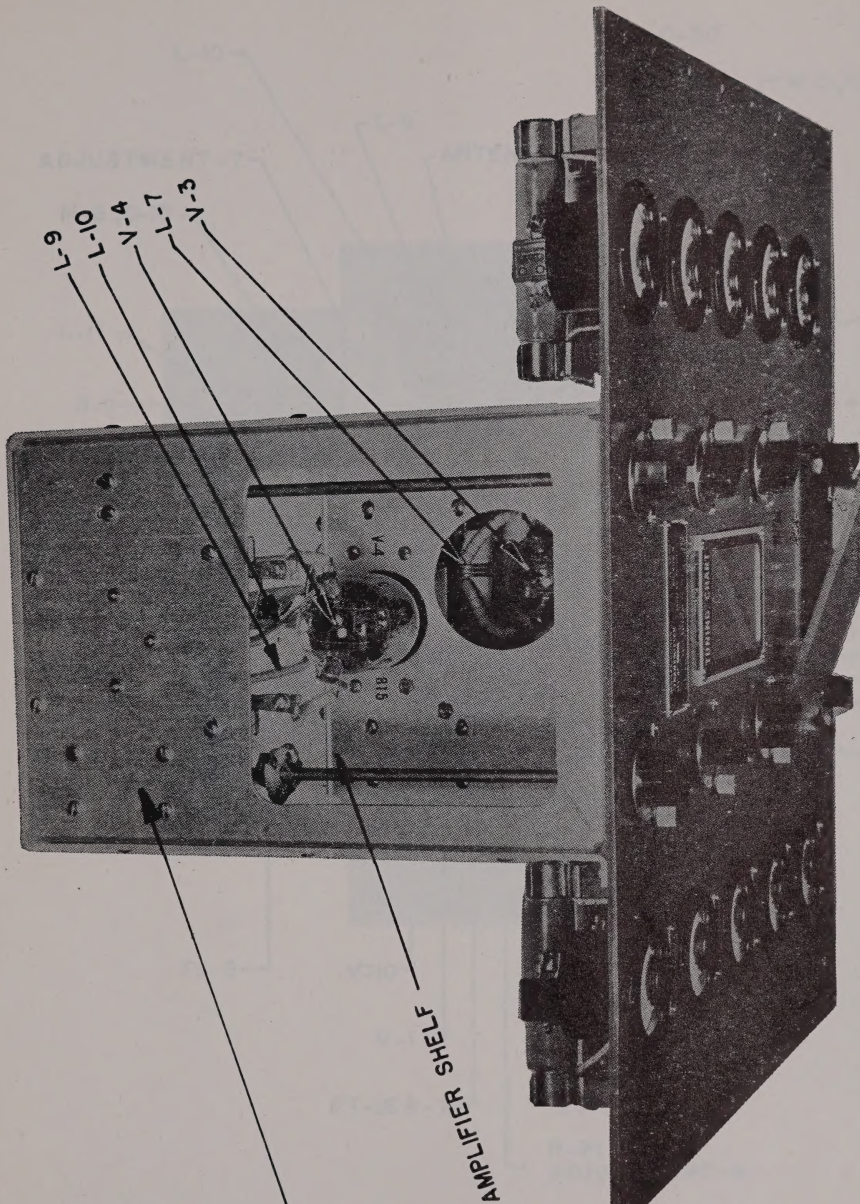

L-9
L-10
V-4
L-7
V-3
V4
815
TOP SHELF
POWER AMPLIFIER SHELF

Fig. 10
Radio Frequency Unit, Top View

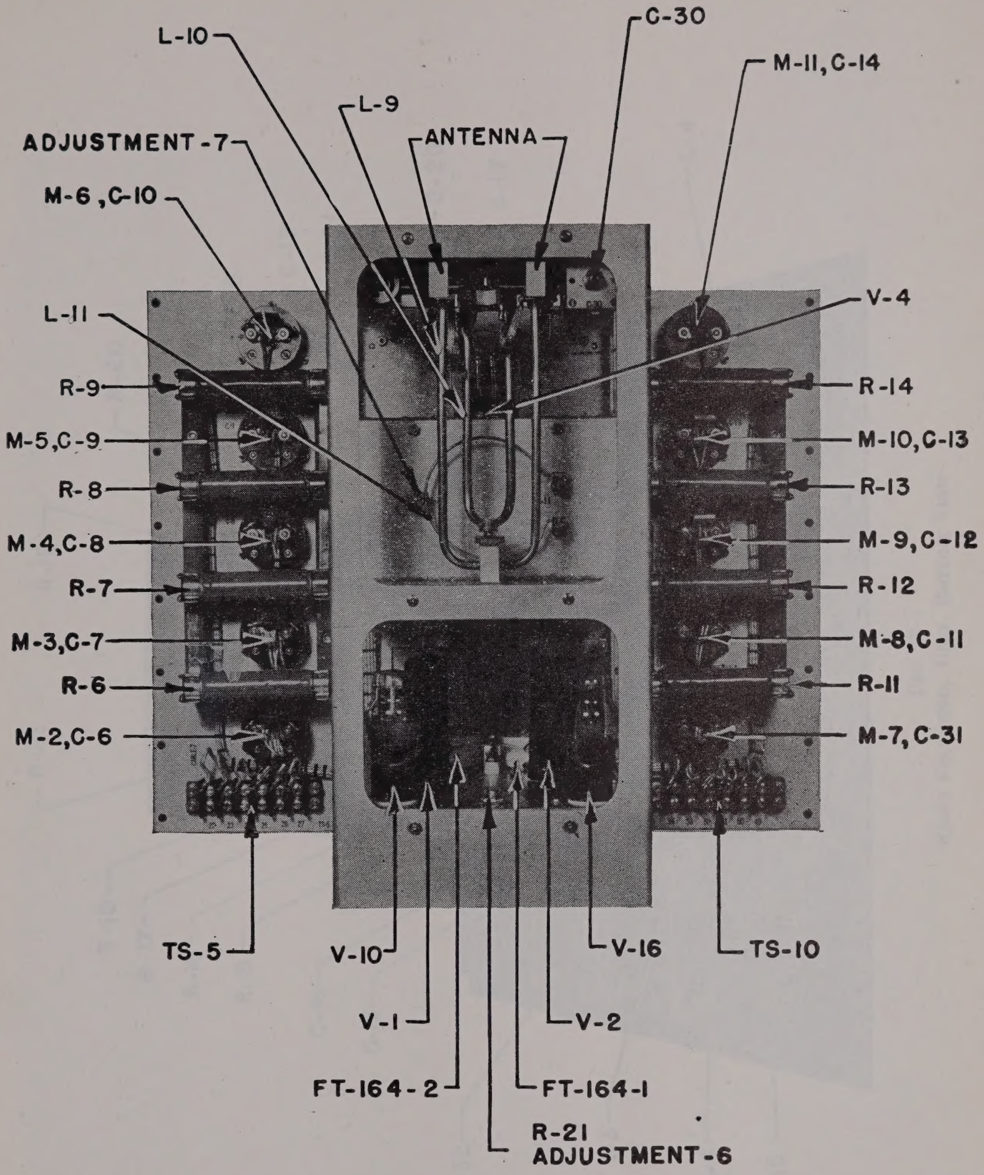

L-10
C-30
M-11, C-14
L-9
ADJUSTMENT-7
ANTENNA
M-6, C-10
L-11
V-4
R-9
R-14
M-5, C-9
M-10, C-13
R-8
R-13
M-4, C-8
M-9, C-12
R-7
R-12
M-3, C-7
M-8, C-11
R-6
R-11
M-2, C-6
M-7, C-31
TS-5
V-10
V-16
TS-10
V-1
V-2
FT-164-2
FT-164-1
R-21
ADJUSTMENT-6

Fig. 11
Radio Frequency Unit, Back View

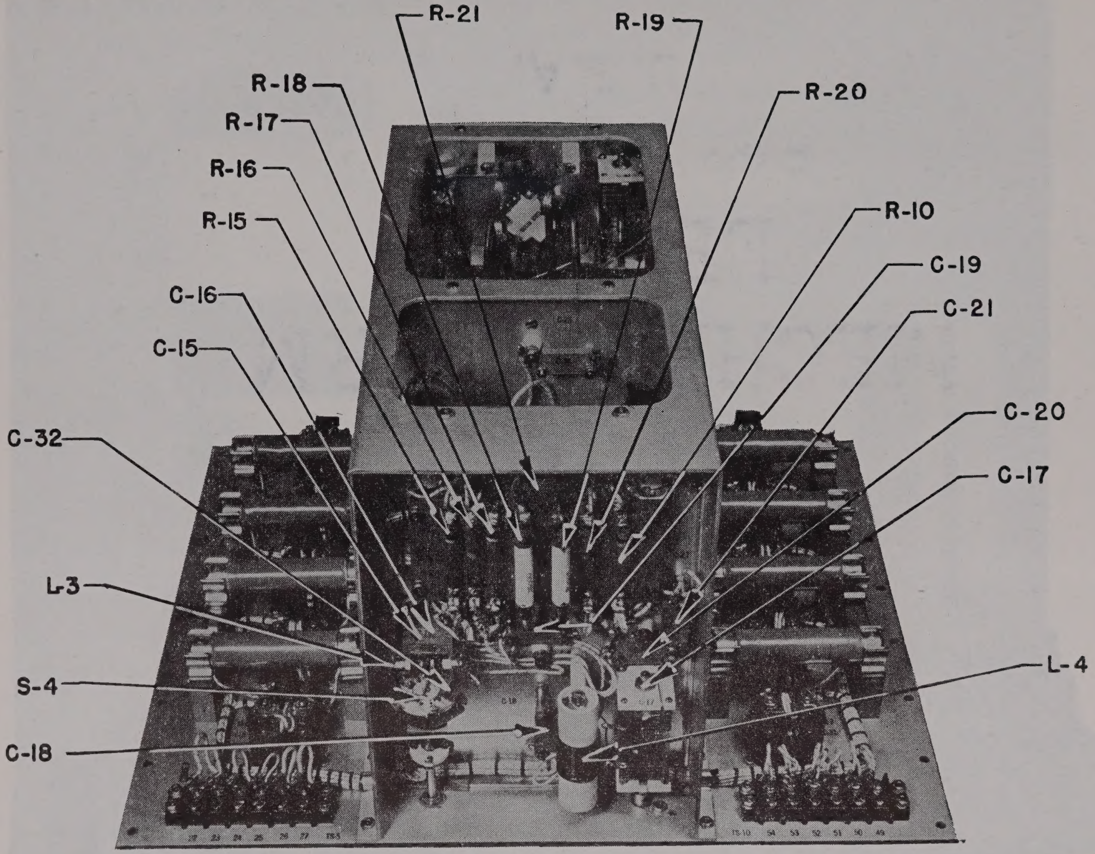

R-21
R-19
R-18
R-17
R-20
R-16
R-15
R-10
C-19
C-21
C-16
C-15
C-20
C-32
C-17
L-3
L-4
S-4
C-18

Fig. 12
Radio Frequency Unit, Bottom View

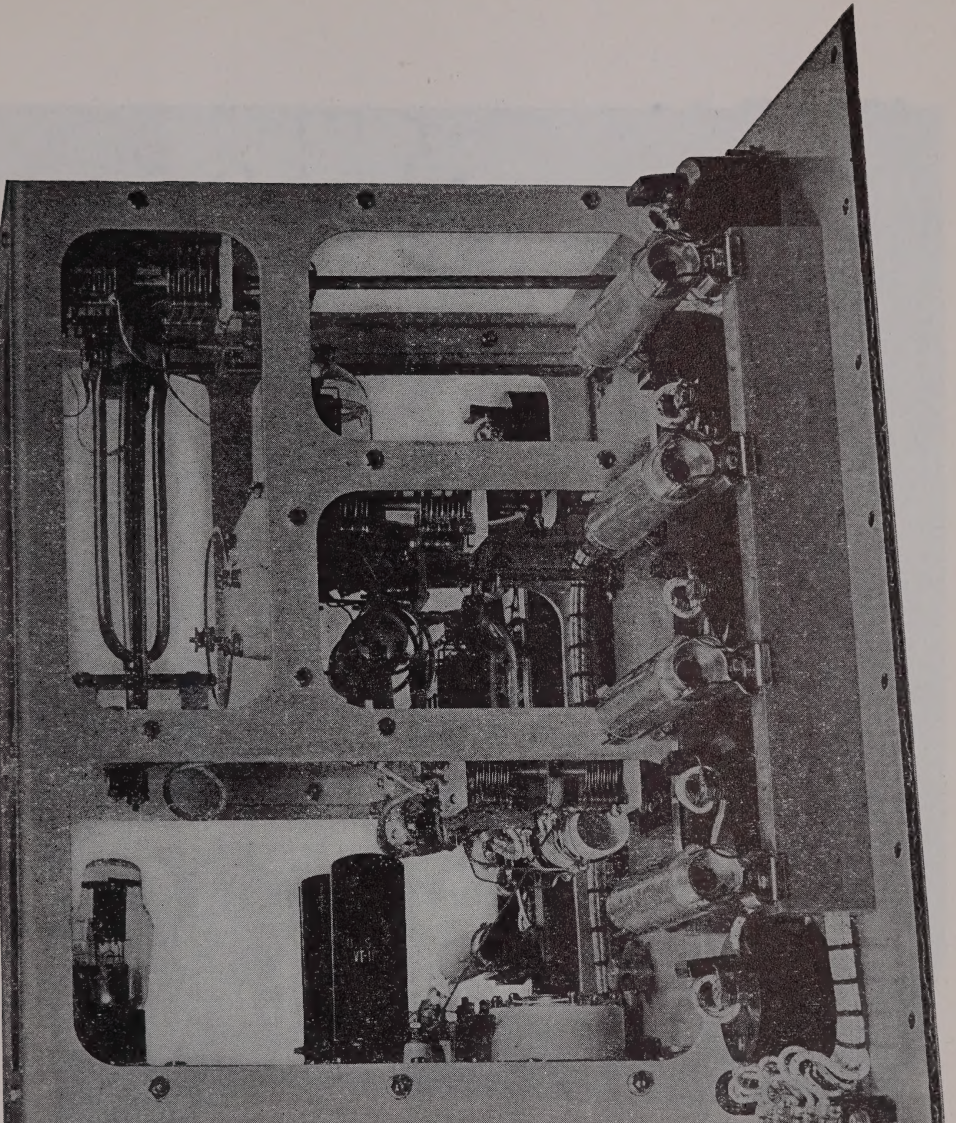


Fig. 13
Radio Frequency Unit, Left Side View

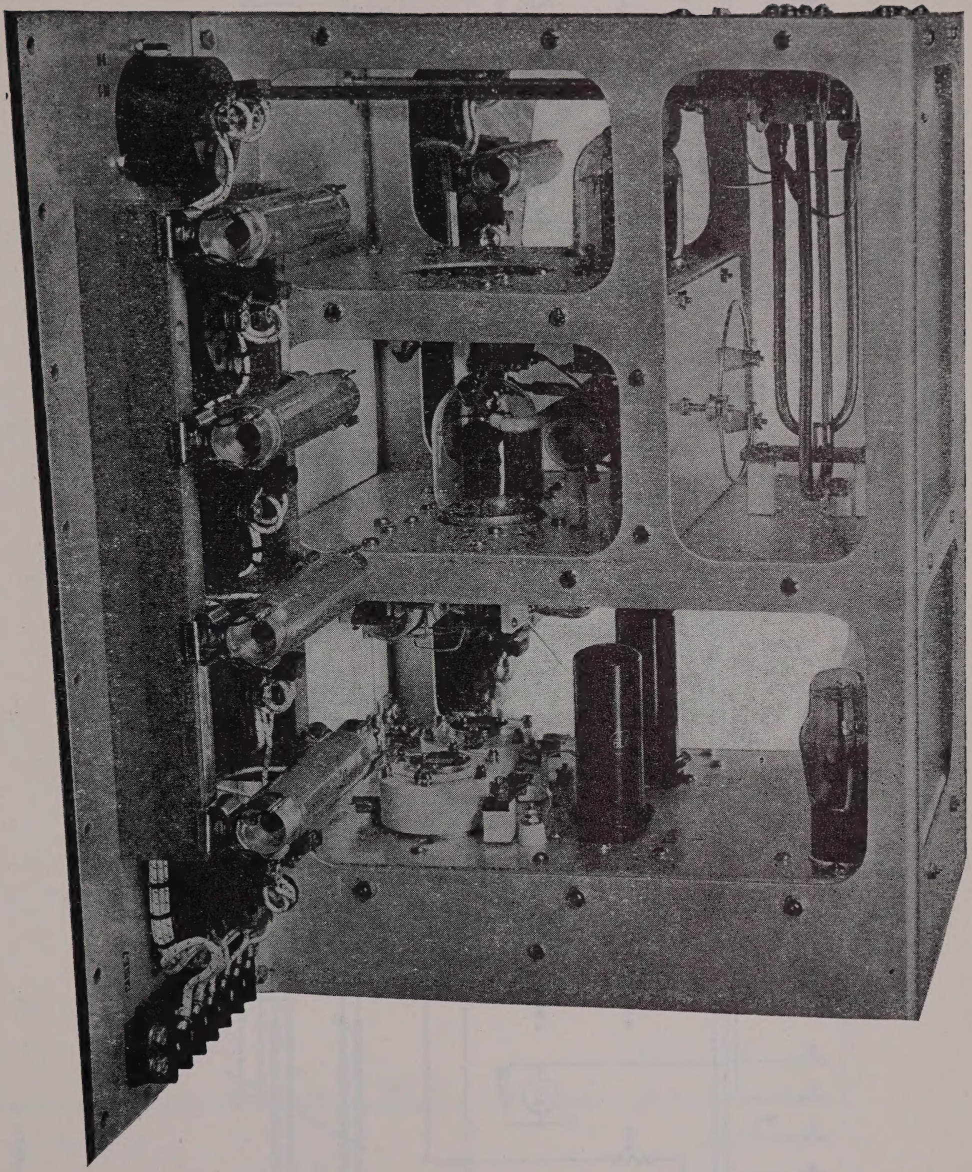


Fig. 14
Radio Frequency Unit, Right Side View

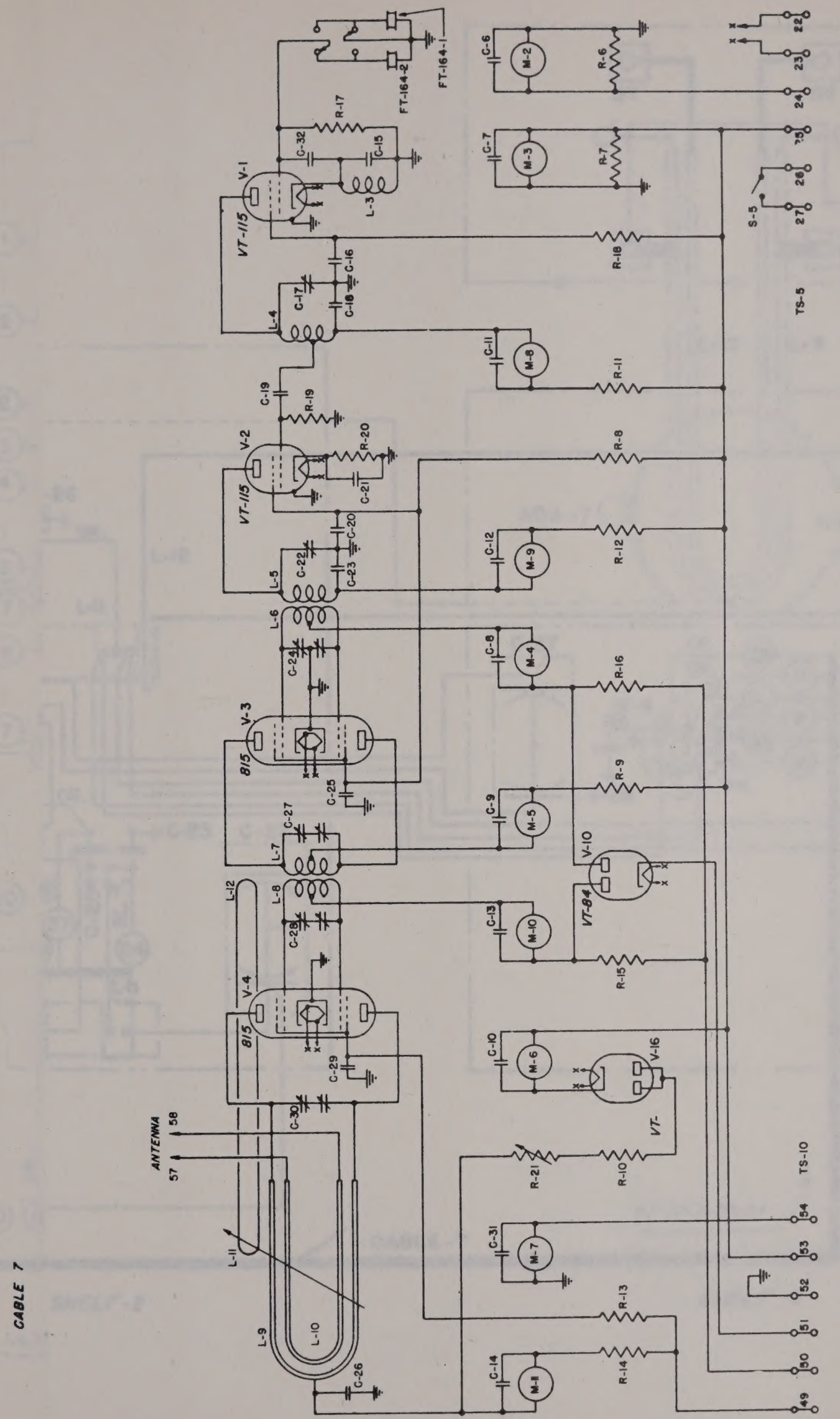
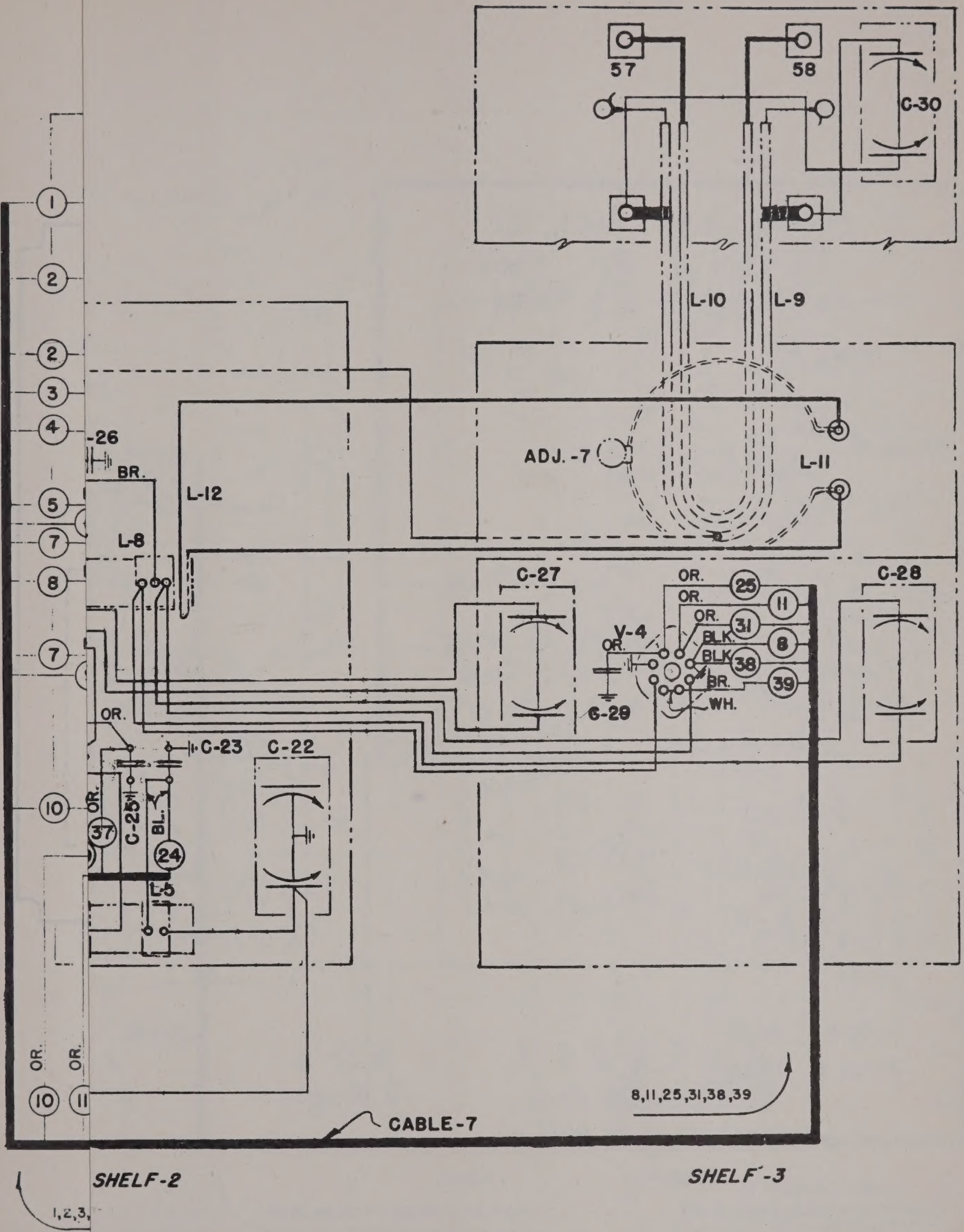

CABLE 7
ANTENNA
57
58
L-9
L-10
L-11
L-12
C-26
C-30
815
V-4
C-29
L-8
C-28
L-7
C-27
815
V-3
C-25
C-24
L-6
L-5
C-22
C-23
C-20
VT-115
V-2
C-21
R-20
R-19
C-19
L-4
C-17
C-18
C-16
VT-115
V-1
C-32
C-15
L-3
R-17
FT-164-2
FT-164-1
C-6
M-2
R-6
C-7
M-3
R-7
R-18
C-11
M-8
R-11
R-8
C-12
M-9
R-12
C-8
M-4
R-16
C-9
M-5
R-9
V-10
VT-84
C-13
M-10
R-15
C-10
M-6
V-16
VT-
R-21
R-10
C-31
M-7
R-13
C-14
M-1
R-14
S-5
TS-5
TS-10
22
23
24
25
26
27
49
50
51
52
53
54

Fig. 15 - Radio Frequency Unit, Schematic Wiring Diagram


57
58
C-30
L-10
L-9
ADJ. -7
L-11
L-12
-26
BR.
L-8
C-27
C-28
OR.
OR.
OR.
OR.
V-4
BLK.
BLK.
BR.
WH.
C-29
OR.
C-23
C-22
C-25
BL.
L-5
OR.
OR.
①
②
②
③
④
⑤
⑦
⑧
⑦
⑩
㊲
㉔
㉕
⑪
㉛
⑧
㊳
㊴
⑩
⑪
CABLE-7
8,11,25,31,38,39
SHELF-2
SHELF-3
1,2,3,

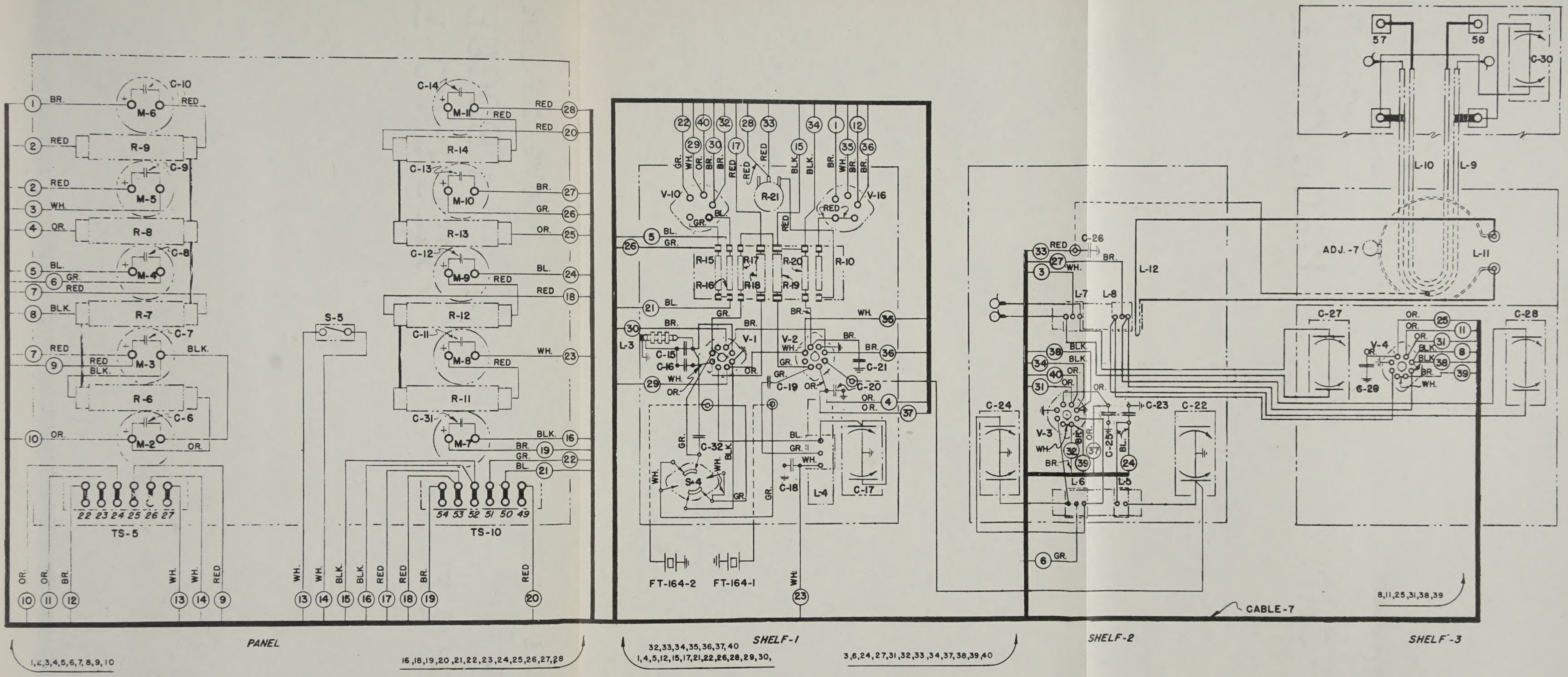
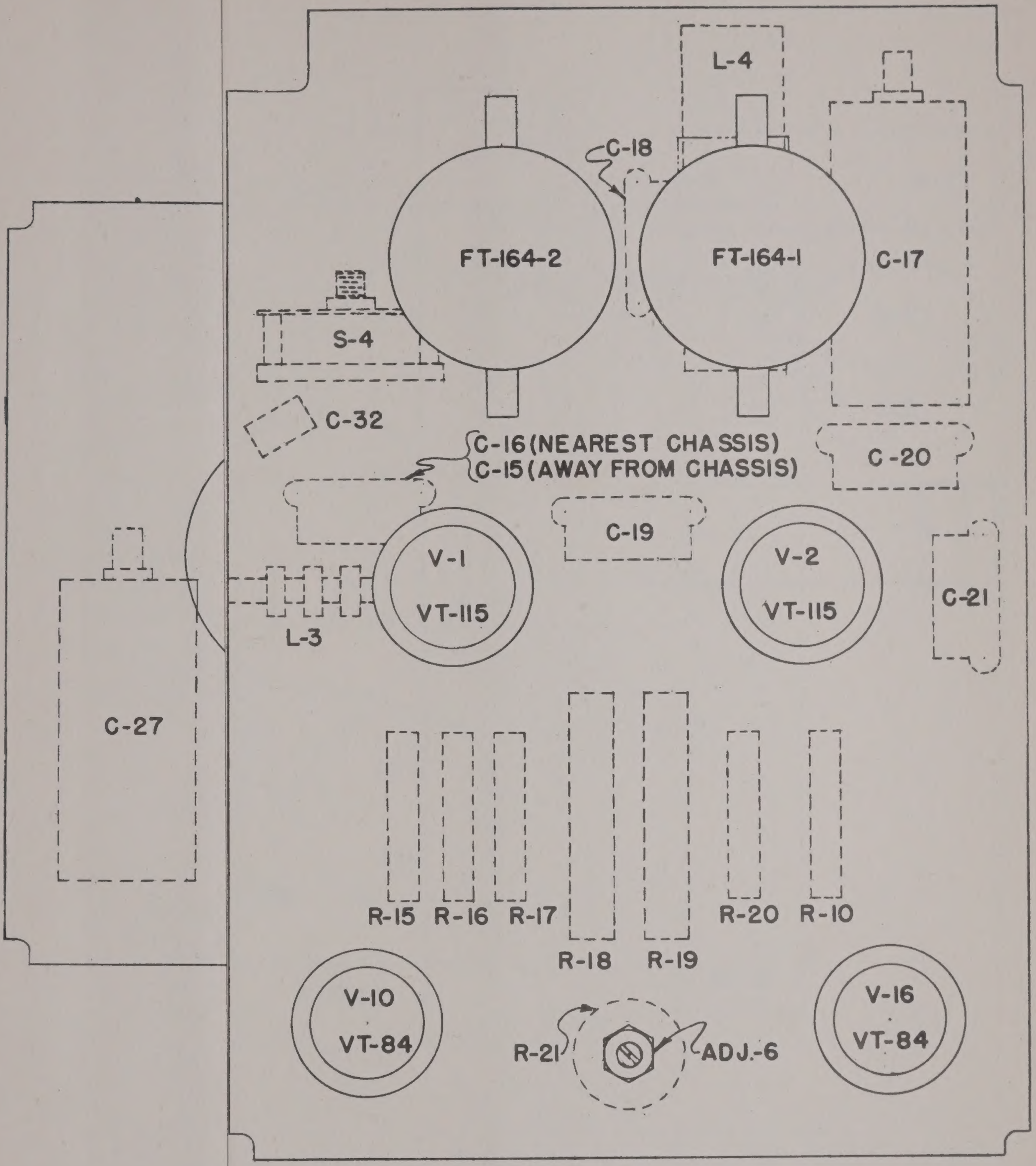
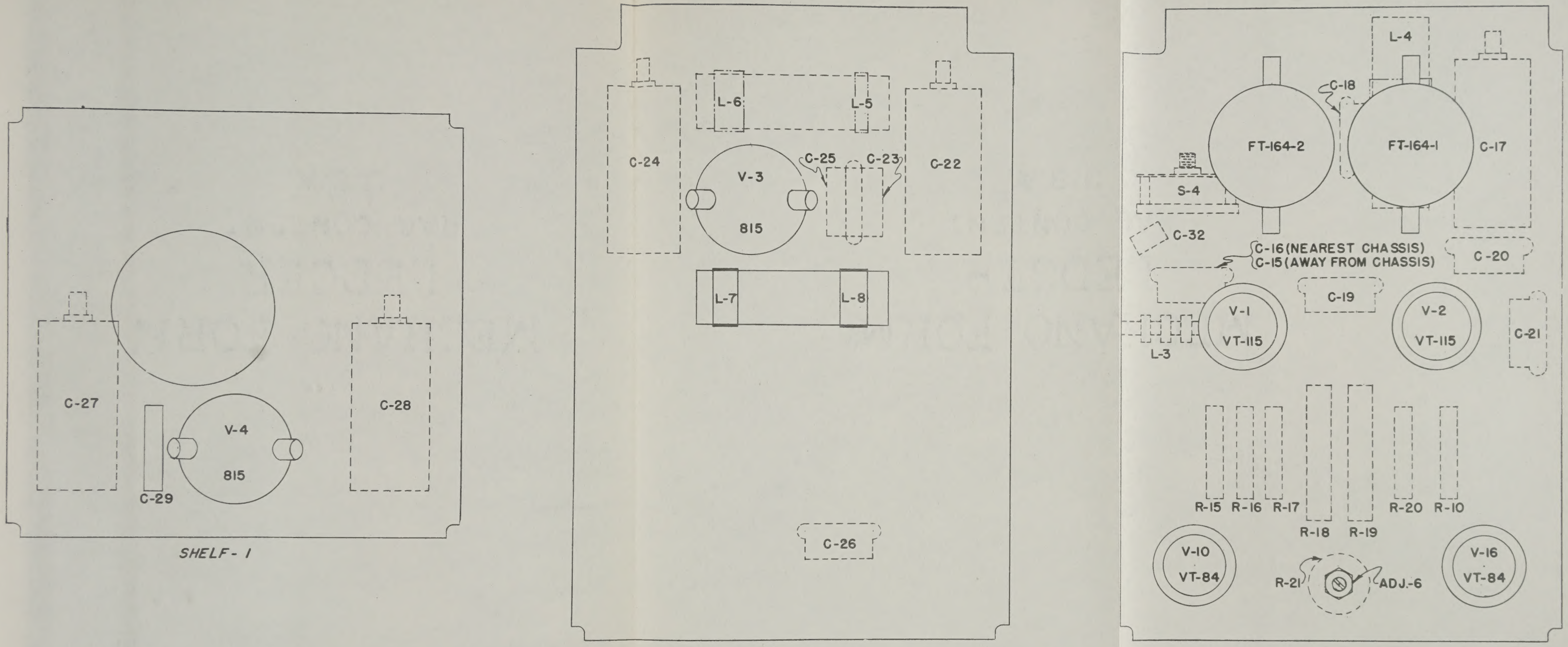

PANEL
SHELF-1
SHELF-2
SHELF-3
CABLE-7
M-6
M-5
M-4
M-3
M-2
M-11
M-10
M-9
M-8
M-7
C-10
C-9
C-8
C-7
C-6
C-14
C-13
C-12
C-11
C-31
R-9
R-8
R-7
R-6
R-14
R-13
R-12
R-11
S-5
TS-5
22 23 24 25 26 27
TS-10
54 53 52 51 50 49
V-10
V-16
R-21
R-15
R-16
R-17
R-18
R-20
R-19
R-10
V-1
V-2
L-3
C-15
C-16
C-19
C-20
C-21
C-32
S-4
C-18
L-4
C-17
FT-164-2
FT-164-1
C-26
L-7
L-8
L-12
V-3
C-23
C-22
C-24
C-25
L-6
L-5
57
58
C-30
L-10
L-9
ADJ.-7
L-11
C-27
C-28
V-4
C-29
BR.
RED
WH.
OR.
BL.
GR.
BLK.
1,2,3,4,5,6,7,8,9,10
16,18,19,20,21,22,23,24,25,26,27,28
32,33,34,35,36,37,40
1,4,5,12,15,17,21,22,26,28,29,30,
3,6,24,27,31,32,33,34,37,38,39,40
8,11,25,31,38,39

Fig. 16 - Radio Frequency Unit, Physical Wiring Diagram


L-4
C-18
FT-164-2
FT-164-1
C-17
S-4
C-32
C-16 (NEAREST CHASSIS)
C-15 (AWAY FROM CHASSIS)
C-20
C-19
V-1
VT-115
V-2
VT-115
C-21
L-3
C-27
R-15
R-16
R-17
R-18
R-19
R-20
R-10
V-10
VT-84
R-21
ADJ.-6
V-16
VT-84

SHELF -3

F


C-27
V-4
815
C-29
C-28
C-24
L-6
L-5
C-22
V-3
815
C-25
C-23
L-7
L-8
C-26
L-4
C-18
FT-164-2
FT-164-1
C-17
S-4
C-32
C-16(NEAREST CHASSIS)
C-15(AWAY FROM CHASSIS)
C-20
C-19
V-1
VT-115
V-2
VT-115
C-21
L-3
R-15
R-16
R-17
R-18
R-19
R-20
R-10
V-10
VT-84
R-21
ADJ.-6
V-16
VT-84

SHELF-1

SHELF-2

SHELF-3

(SHELVES AS VIEWED FROM TOP OF TRANSMITTER)

Fig. 17 - Radio Frequency Shelves, Location Diagram, Top View

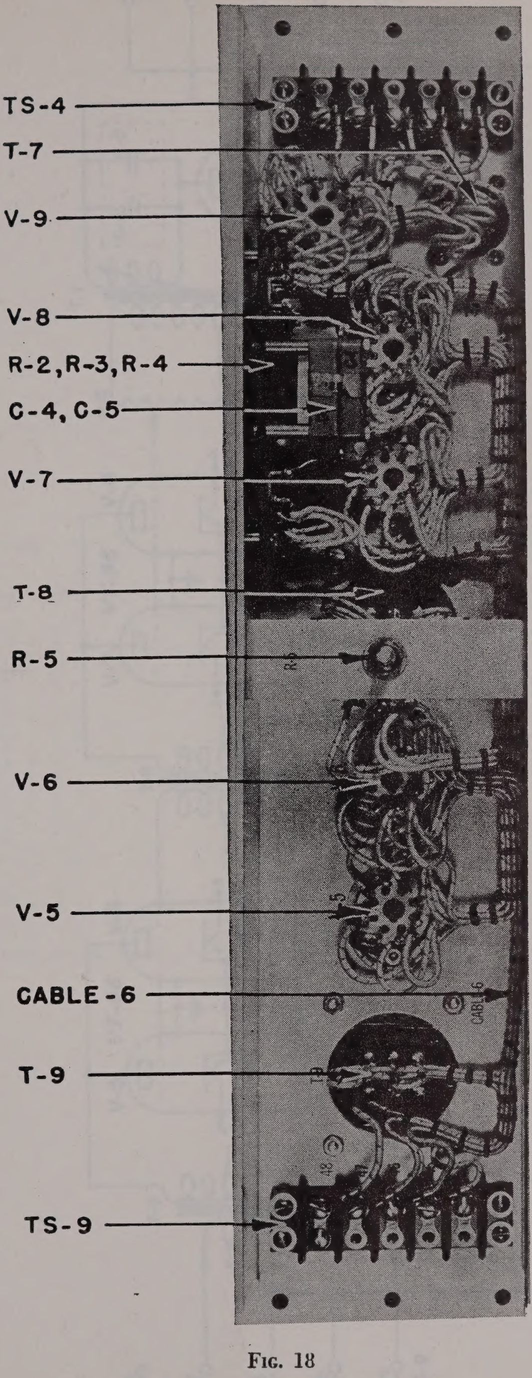

TS-4
T-7
V-9
V-8
R-2, R-3, R-4
C-4, C-5
V-7
T-8
R-5
V-6
V-5
CABLE-6
T-9
TS-9

Fig. 18
Modulator Unit, Front View

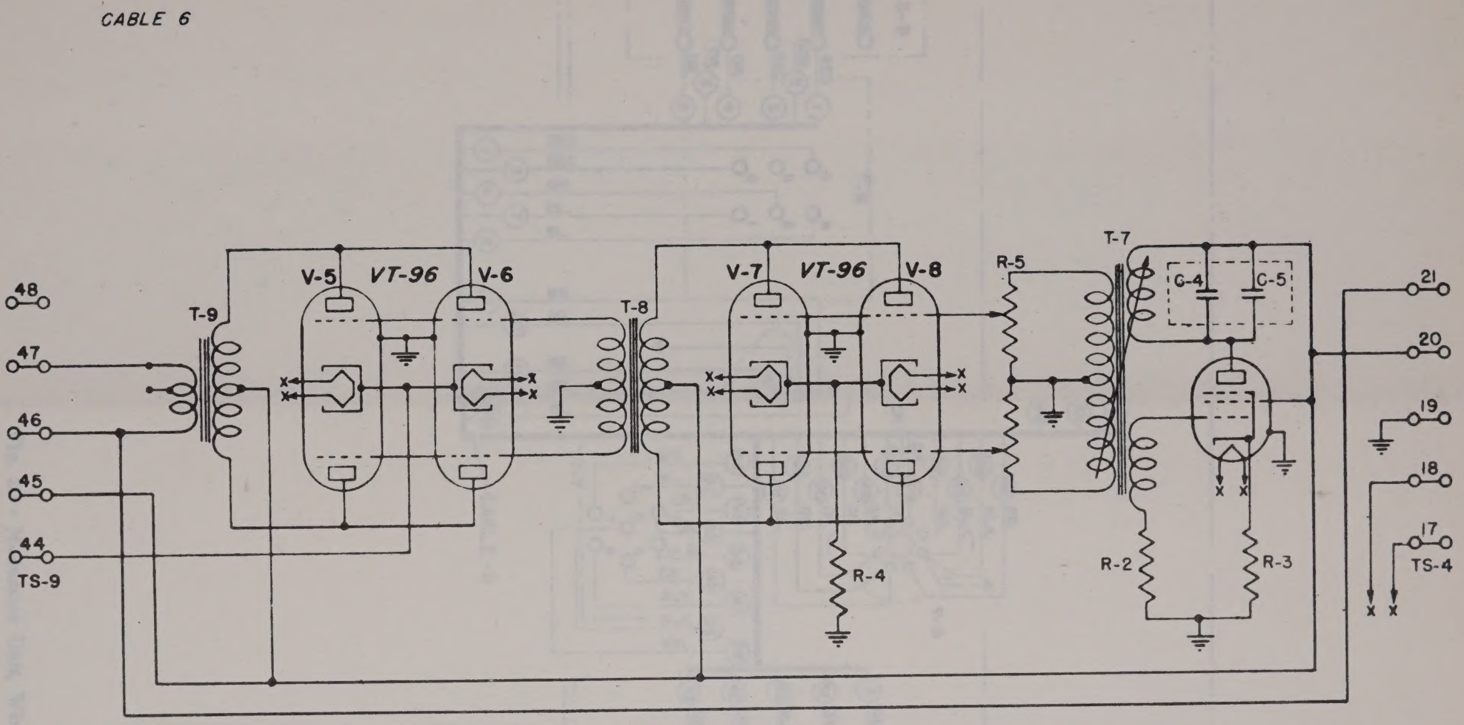

CABLE 6
48
47
46
45
44
TS-9
T-9
V-5
VT-96
V-6
T-8
V-7
VT-96
V-8
R-4
R-5
T-7
C-4
C-5
R-2
R-3
21
20
19
18
17
TS-4
X

Fig. 19 - Modulator Unit, Schematic Wiring Diagram

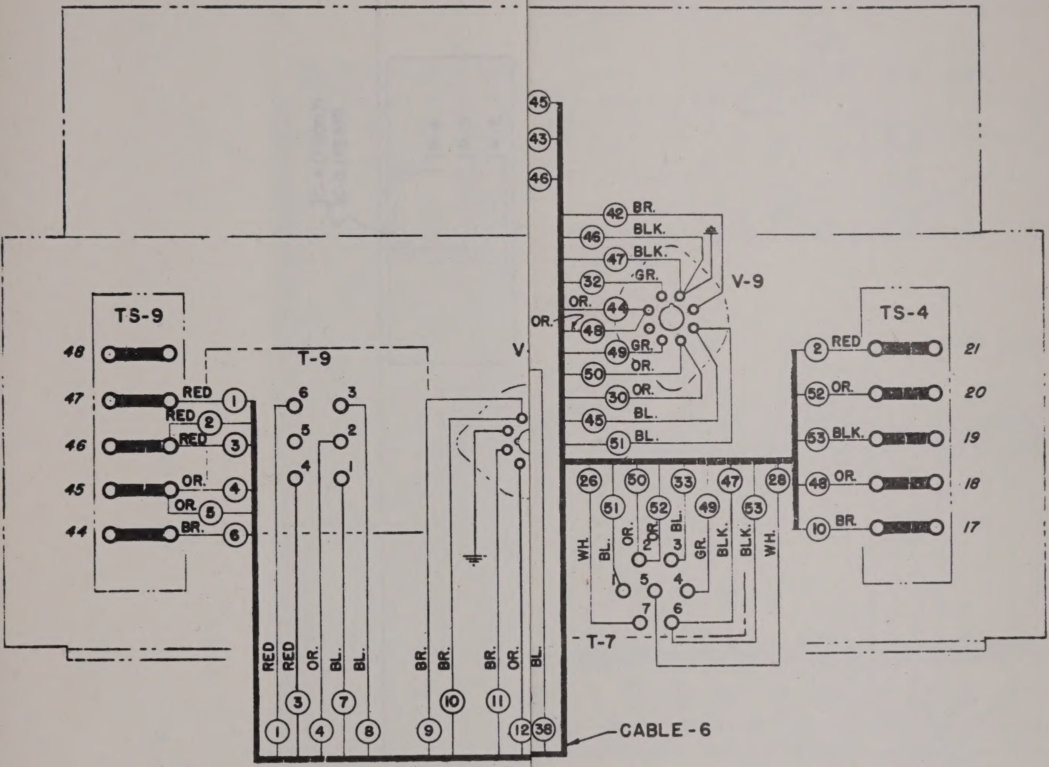

TS-9
48
47
46
45
44
RED
RED
RED
OR.
OR.
BR.
T-9
V
V-9
BR.
BLK.
BLK.
GR.
OR.
OR.
GR.
OR.
OR.
BL.
BL.
TS-4
RED
OR.
BLK.
OR.
BR.
21
20
19
18
17
T-7
WH.
BL.
OR.
OR.
BL.
GR.
BLK.
BLK.
WH.
RED
RED
OR.
BL.
BL.
BR.
BR.
BR.
OR.
BL.
CABLE-6

Fig. 20 - Modulator Unit, Wiring Diagram

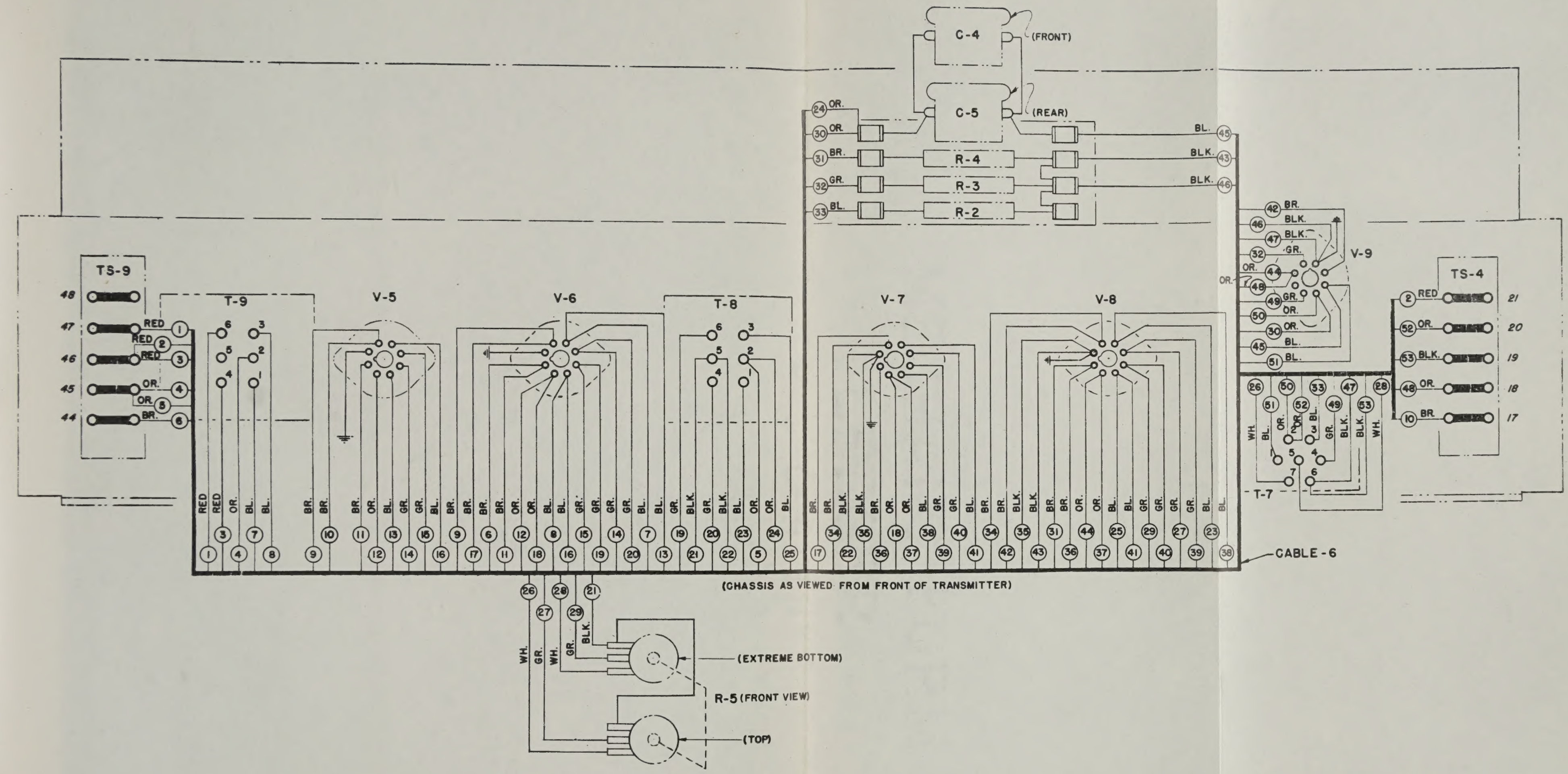
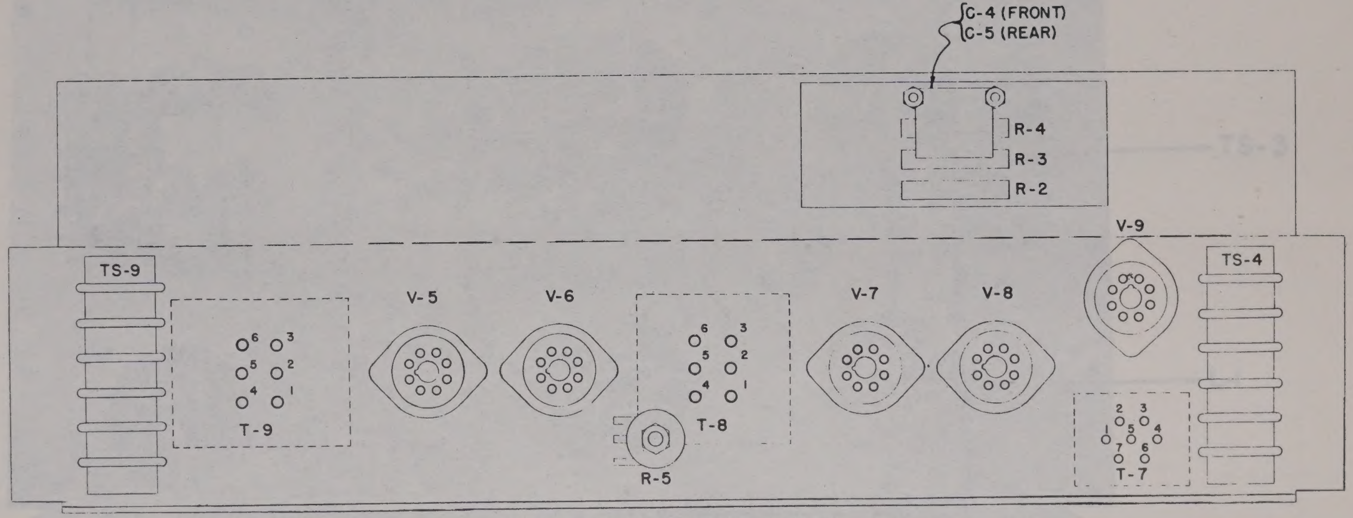

C-4
(FRONT)
C-5
(REAR)
R-4
R-3
R-2
TS-9
T-9
V-5
V-6
T-8
V-7
V-8
V-9
TS-4
T-7
CABLE-6
(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)
(EXTREME BOTTOM)
R-5 (FRONT VIEW)
(TOP)
48
47
46
45
44
21
20
19
18
17
RED
OR.
BR.
BL.
BLK.
GR.
WH.

Fig. 20 - Modulator Unit, Wiring Diagram


C-4 (FRONT)
C-5 (REAR)
R-4
R-3
R-2
V-9
TS-9
V-5
V-6
V-7
V-8
TS-4
T-9
T-8
R-5
T-7
1
2
3
4
5
6
7

(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)

Fig. 21 - Modulator Unit, Part Location Diagram

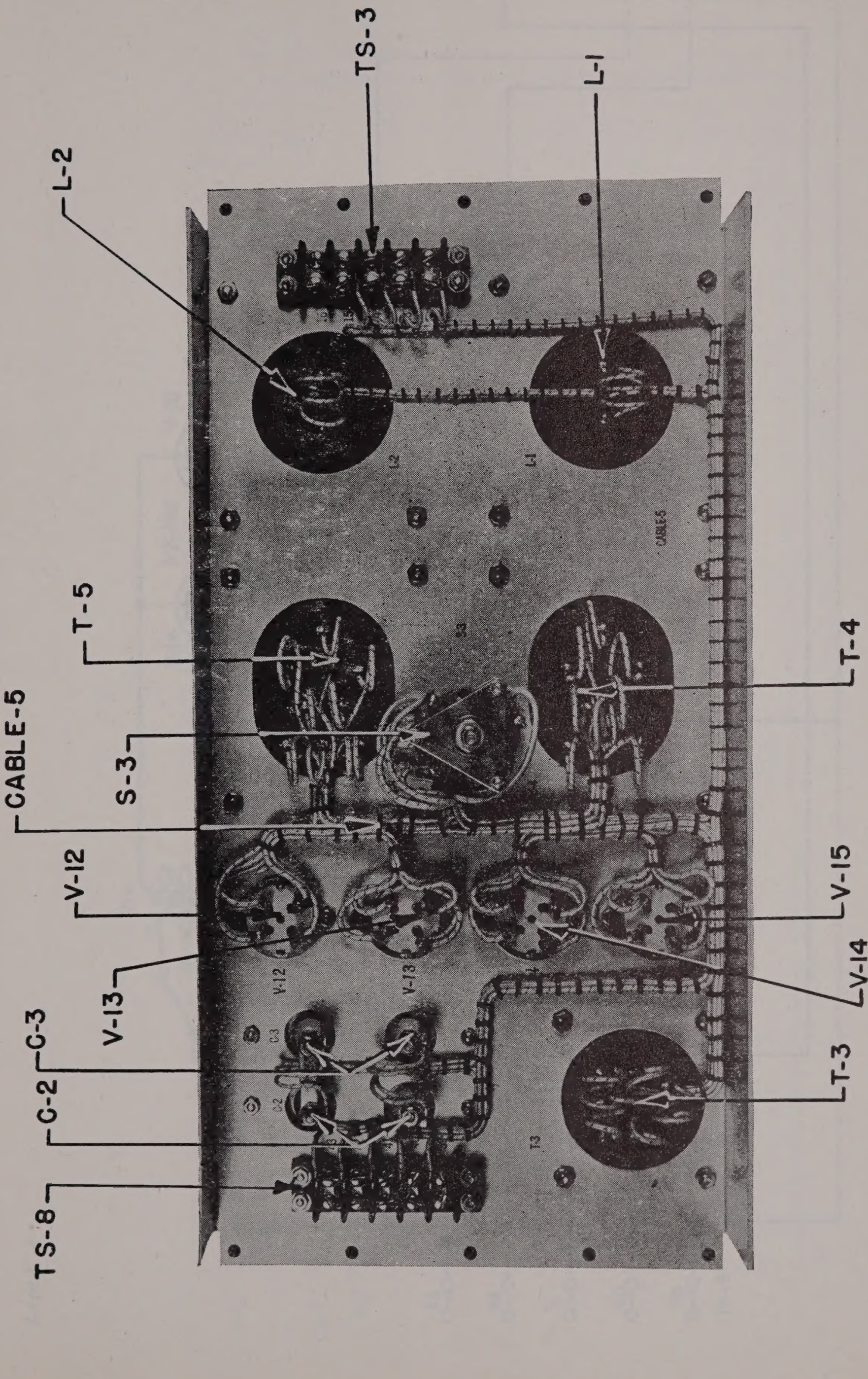

TS-3
L-2
L-1
T-5
CABLE-5
S-3
V-12
V-13
C-3
C-2
TS-8
T-4
V-15
V-14
T-3

Fig. 22
Power Supply Unit, Front View

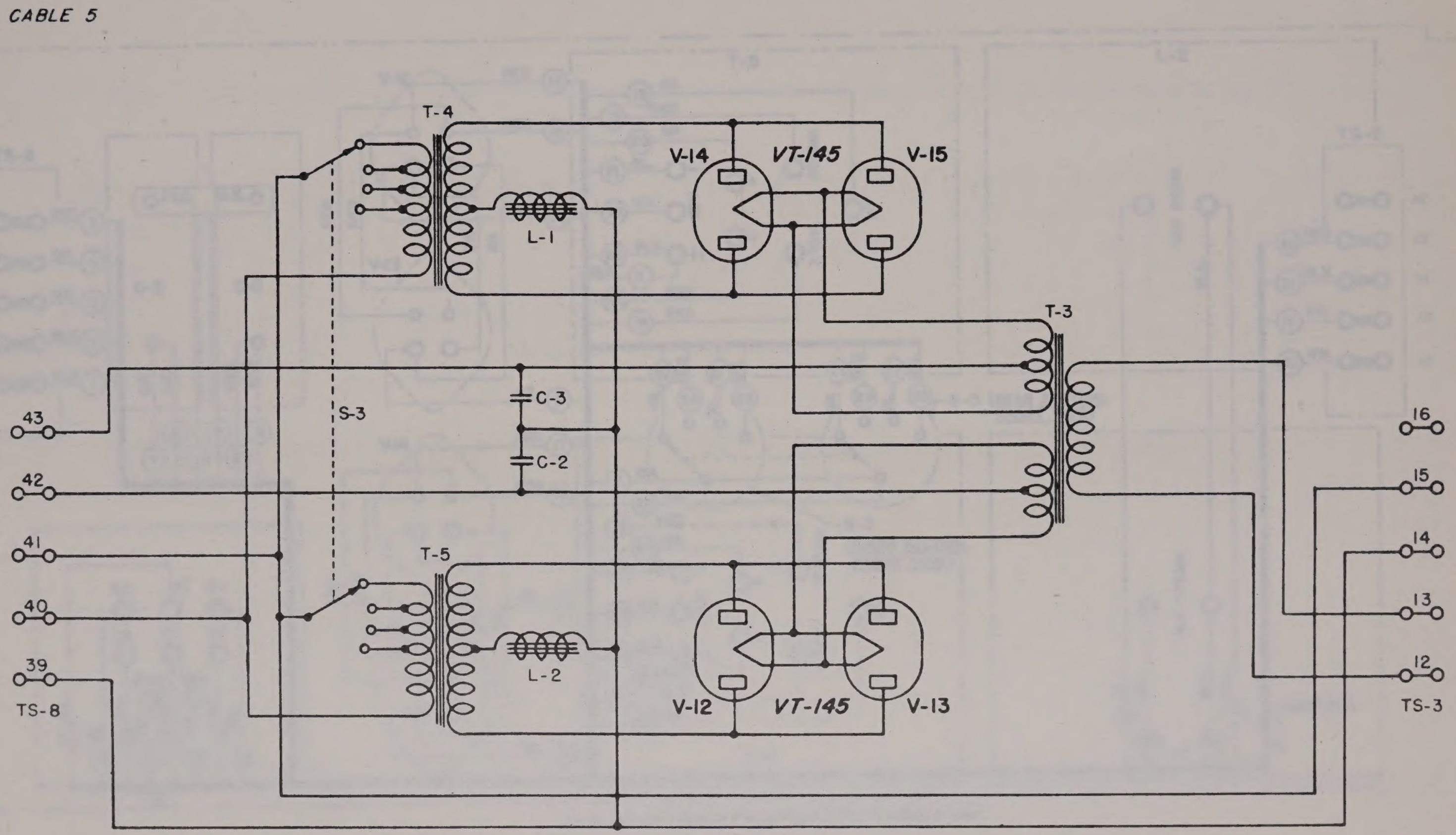
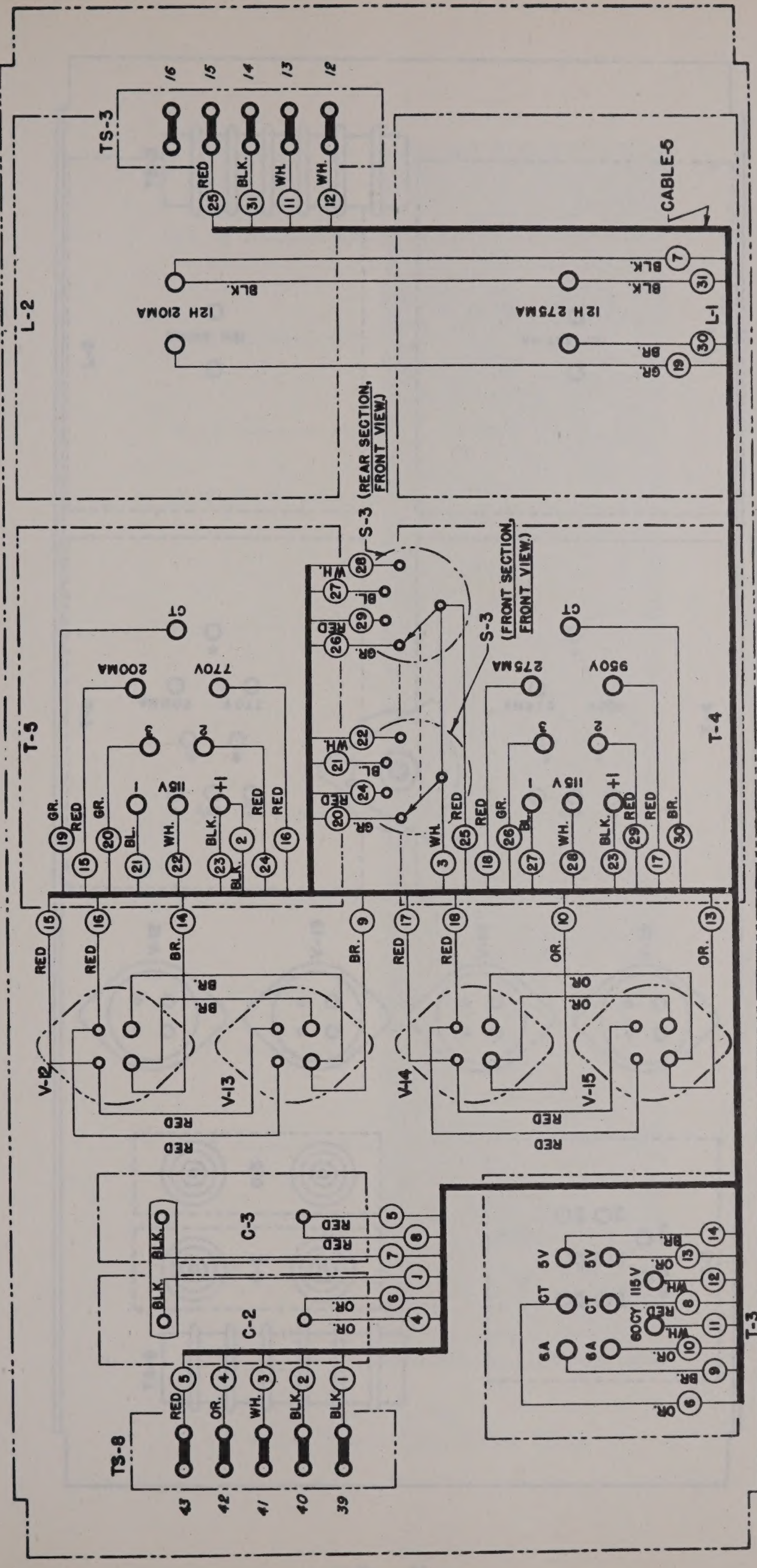
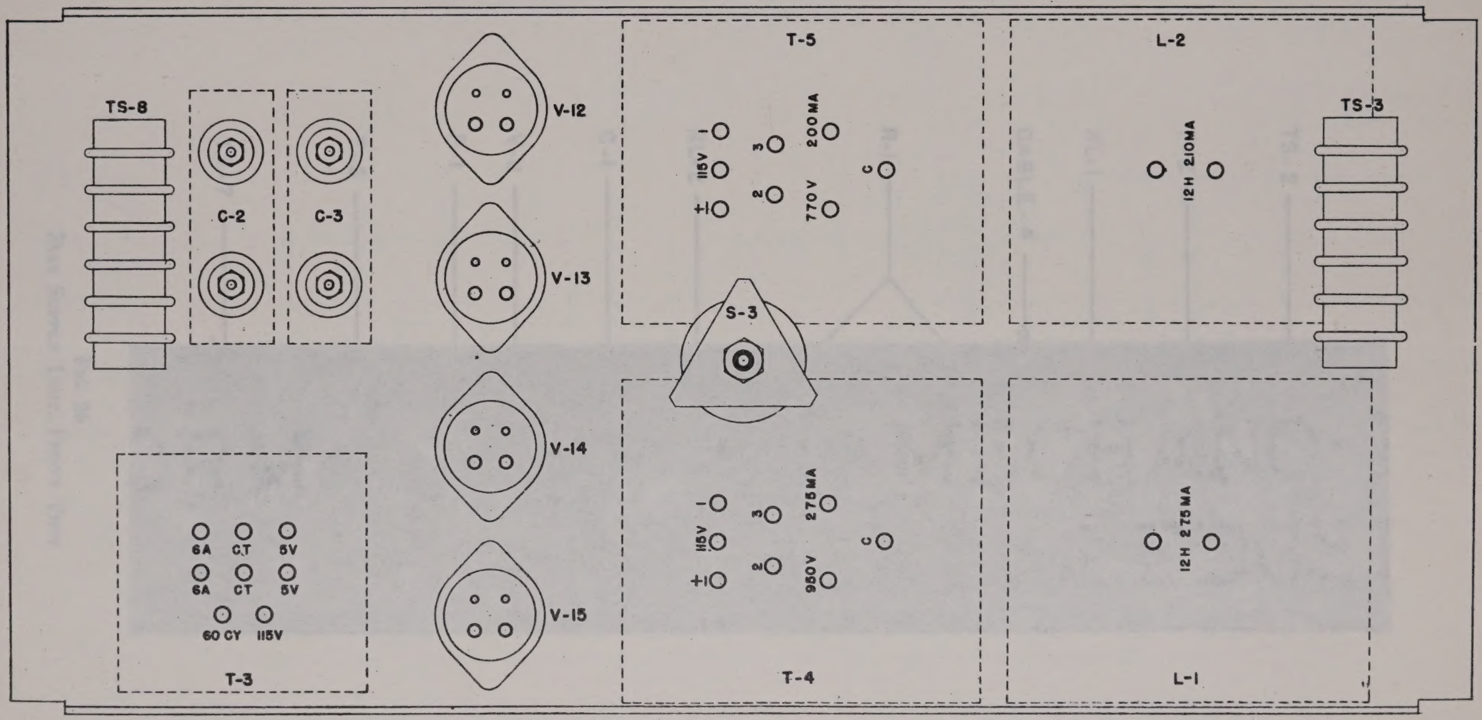

CABLE 5
T-4
V-14
VT-145
V-15
L-1
T-3
S-3
C-3
C-2
43
42
41
40
39
TS-8
T-5
L-2
V-12
VT-145
V-13
16
15
14
13
12
TS-3

Fig. 23 - Power Supply Unit, Schematic Wiring Diagram


TS-3
L-2
12H 210MA
12H 275MA
L-1
CABLE-5
T-5
200MA
770V
115V
CT
S-3 (REAR SECTION, FRONT VIEW)
S-3 (FRONT SECTION, FRONT VIEW)
T-4
275MA
950V
V-12
V-13
V-14
V-15
C-3
C-2
TS-8
T-3
5V
CT
6A
60CY 115V

(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)

Fig. 24 - Power Supply Unit, Physical Wiring Diagram


TS-8
C-2
C-3
V-12
V-13
V-14
V-15
T-3
6A
CT
5V
6A
CT
5V
60 CY
115V
T-5
-
115V
+
3
2
200 MA
770 V
C
S-3
T-4
-
115V
+
3
2
275 MA
950V
C
L-2
12H 210MA
L-1
12H 275MA
TS-3

(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)

Fig. 25 - Power Supply Unit, Part Location Diagram

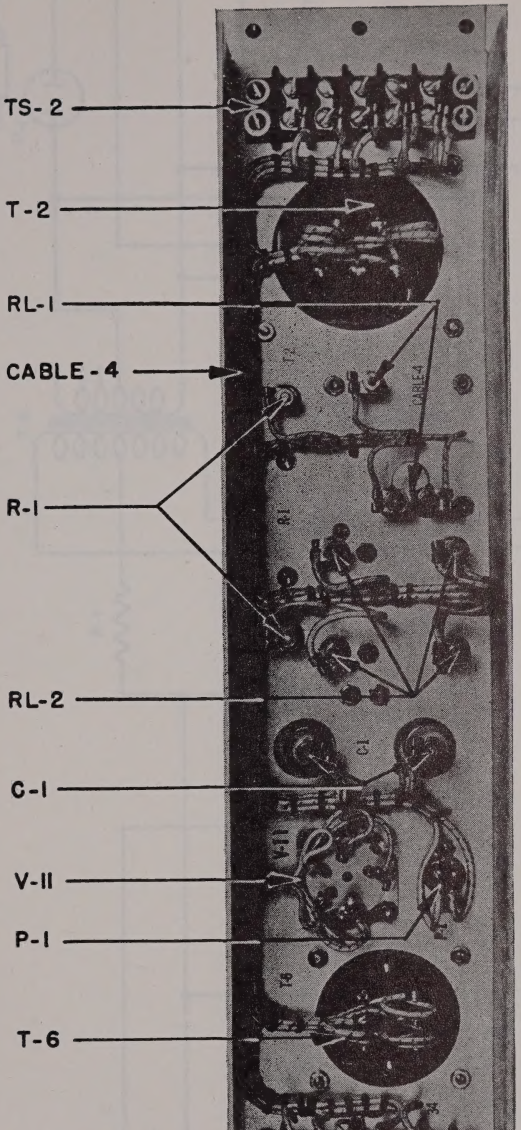

TS-2
T-2
RL-1
CABLE-4
R-1
RL-2
C-1
V-11
P-1
T-6
TS-7

Fig. 26
Bias Supply Unit, Front View

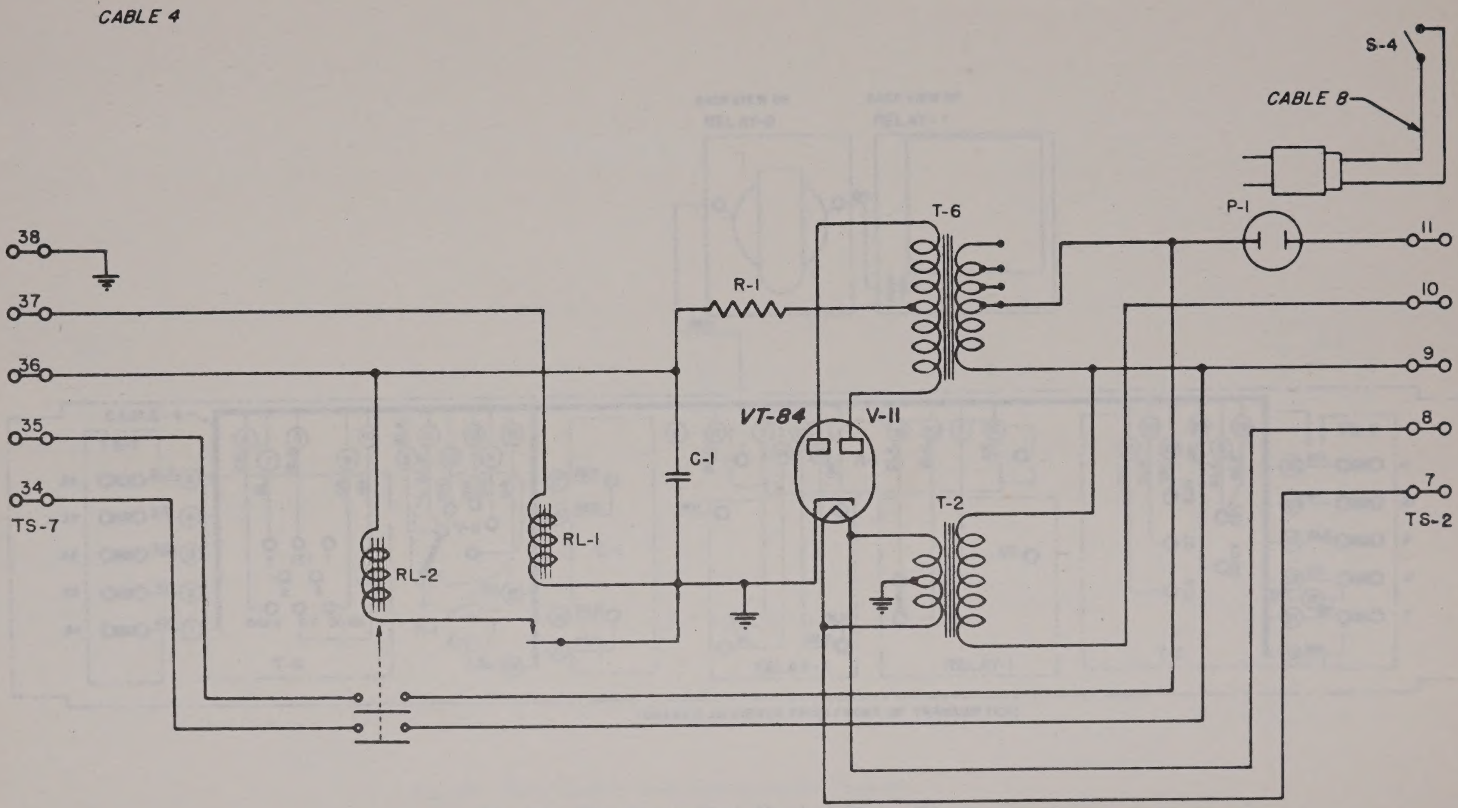
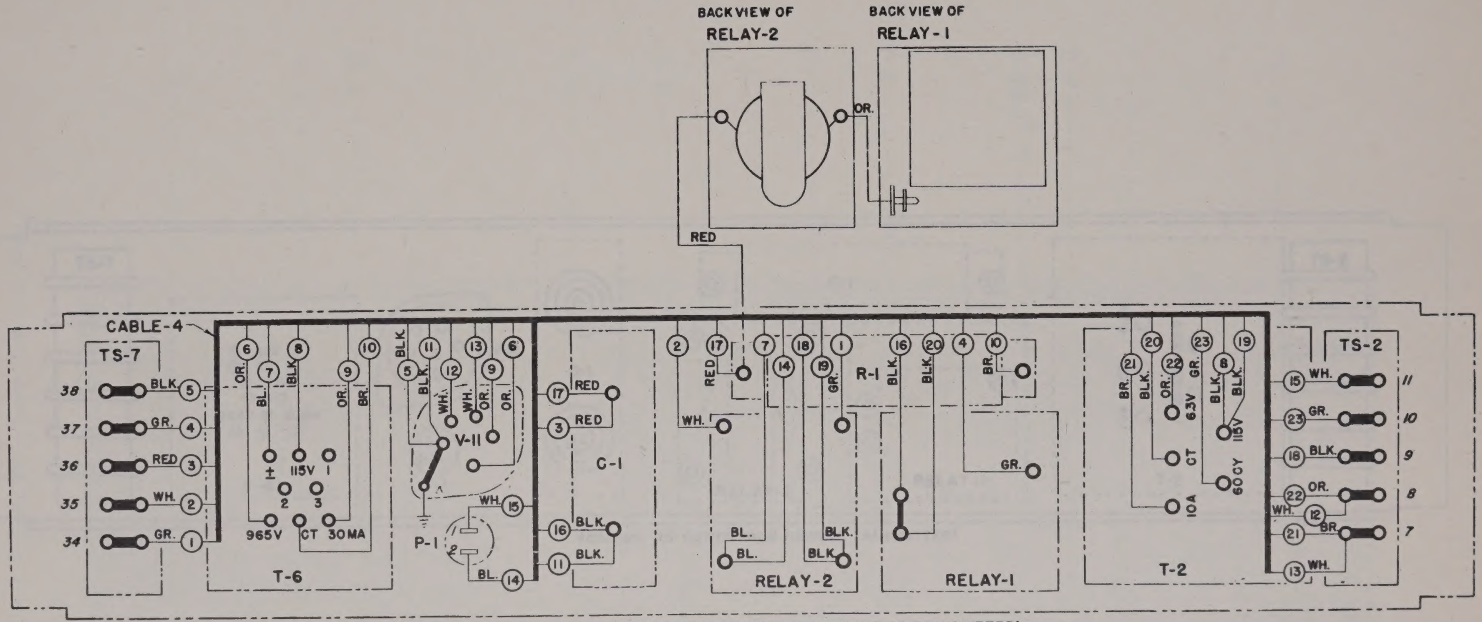
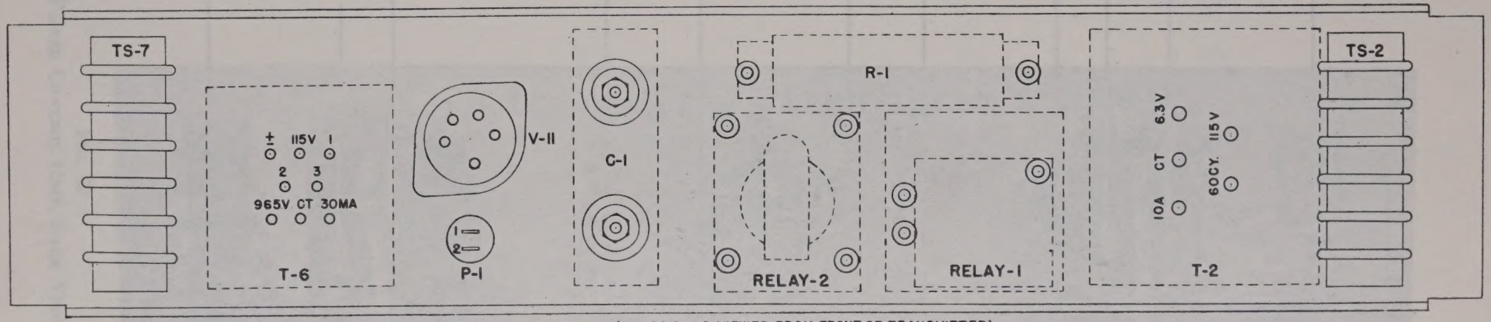

CABLE 4
S-4
CABLE 8
P-1
T-6
R-1
38
37
36
35
34
TS-7
VT-84
V-11
C-1
RL-1
RL-2
T-2
11
10
9
8
7
TS-2

Fig. 27 - Bias Supply Unit, Schematic Wiring Diagram


BACK VIEW OF RELAY-2
BACK VIEW OF RELAY-1
OR.
RED
CABLE-4
TS-7
38
37
36
35
34
BLK.
GR.
RED
WH.
GR.
T-6
OR.
BL.
BLK
BR.
±
115V
1
2
3
965V
CT
30MA
V-11
P-1
BLK
WH.
BL.
C-1
RED
RED
BLK.
BLK.
R-1
RELAY-2
RELAY-1
T-2
6.3V
CT
10A
115V
60CY
TS-2
11
10
9
8
7

(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)

Fig. 28 - Bias Supply Unit, Physical Wiring Diagram


TS-7
±
115V
1
2
3
965V CT 30MA
T-6
V-11
P-1
1
2
C-1
R-1
RELAY-2
RELAY-1
6.3V
CT
10A
115V
60CY.
T-2
TS-2

(CHASSIS AS VIEWED FROM FRONT OF TRANSMITTER)

Fig. 29 - Bias Supply Unit, Part Location Diagram

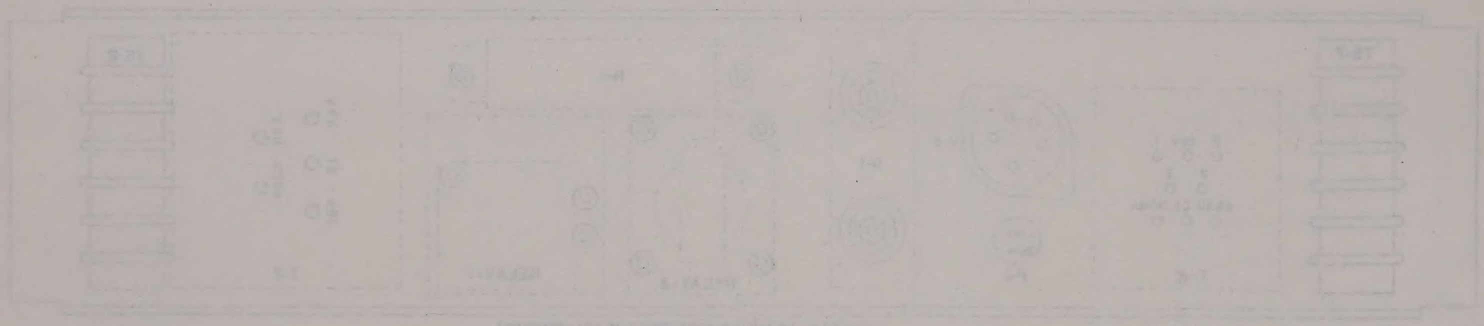


Fig. 29 - Bias Supply Unit, Part Location Diagram

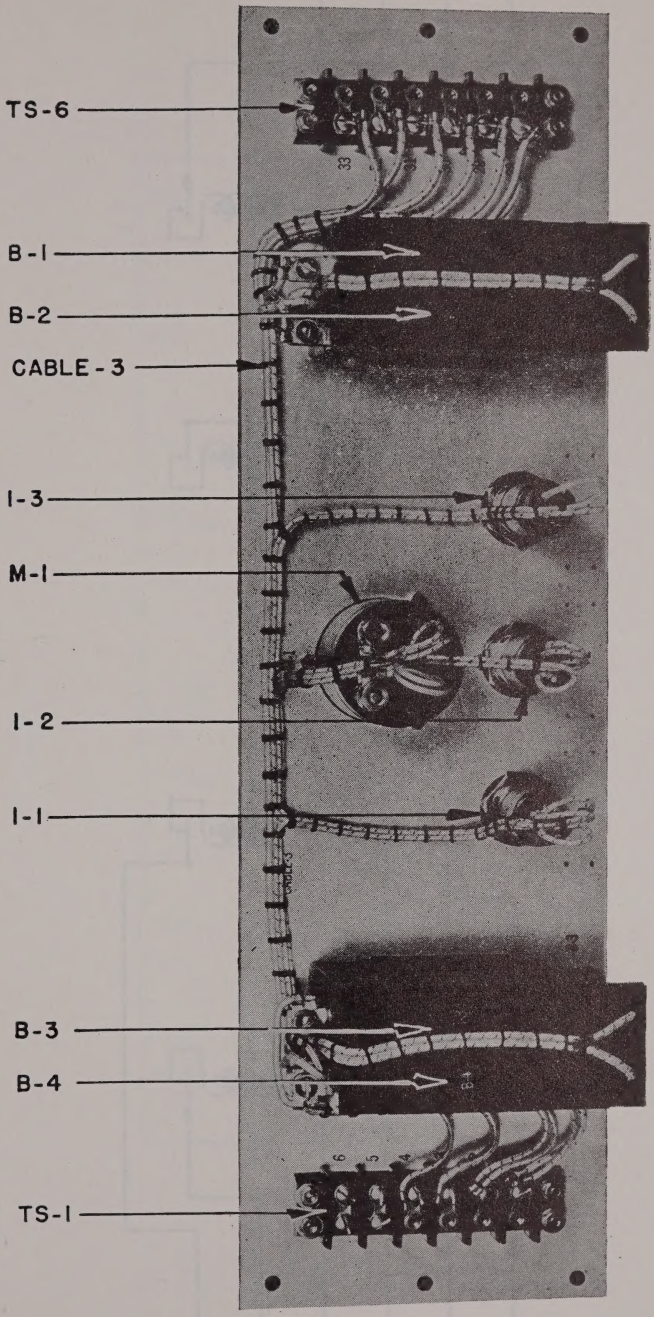

TS-6
B-1
B-2
CABLE-3
1-3
M-1
1-2
1-1
B-3
B-4
TS-1

Fig. 30
Power Control Unit, Back View

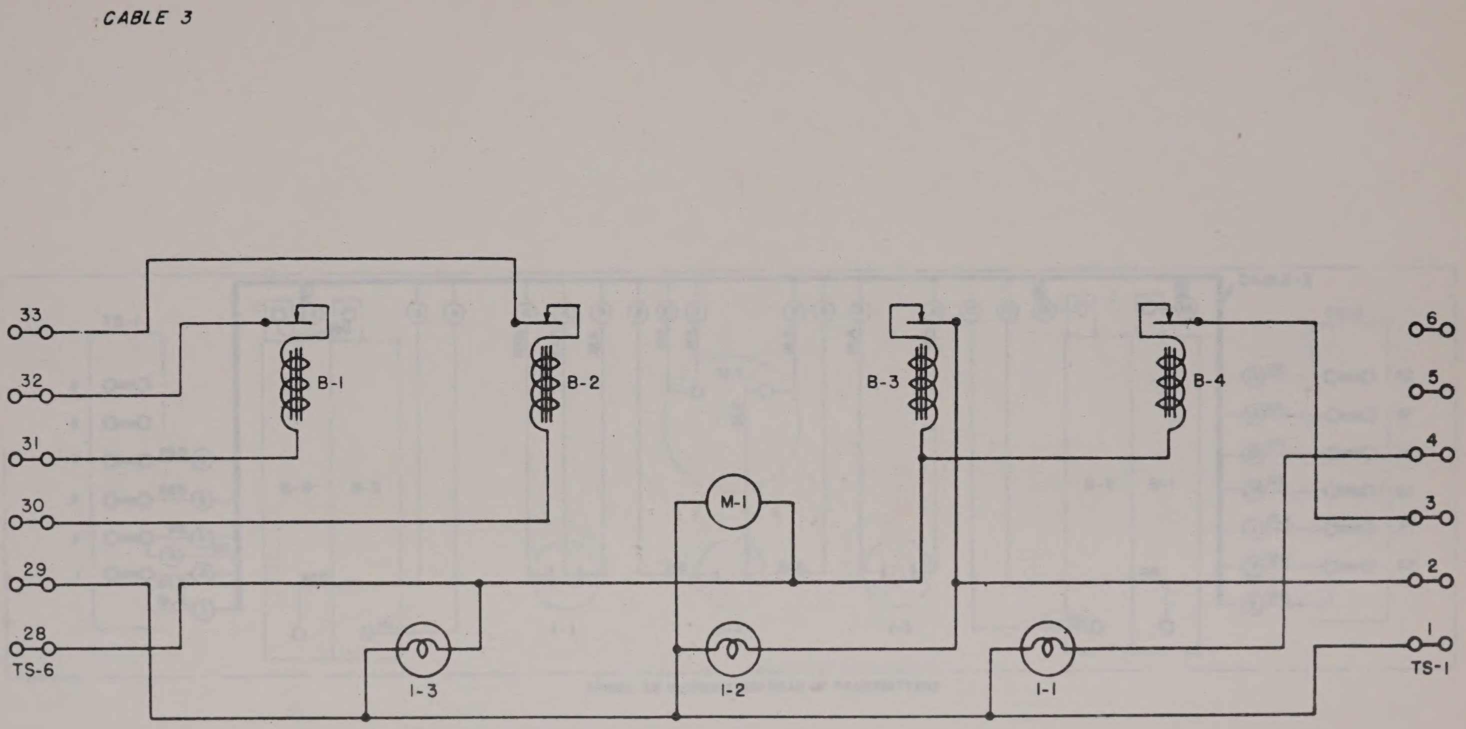

CABLE 3
33
32
31
30
29
28
TS-6
B-1
B-2
M-1
B-3
B-4
I-3
I-2
I-1
6
5
4
3
2
1
TS-1

Fig. 31 - Power Control Unit, Schematic Wiring Diagram

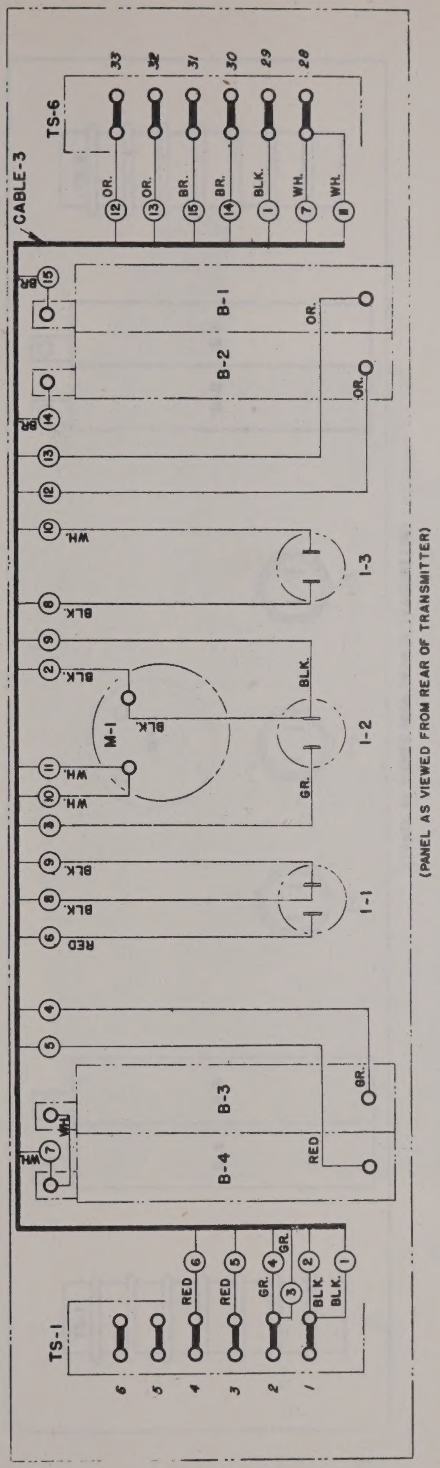
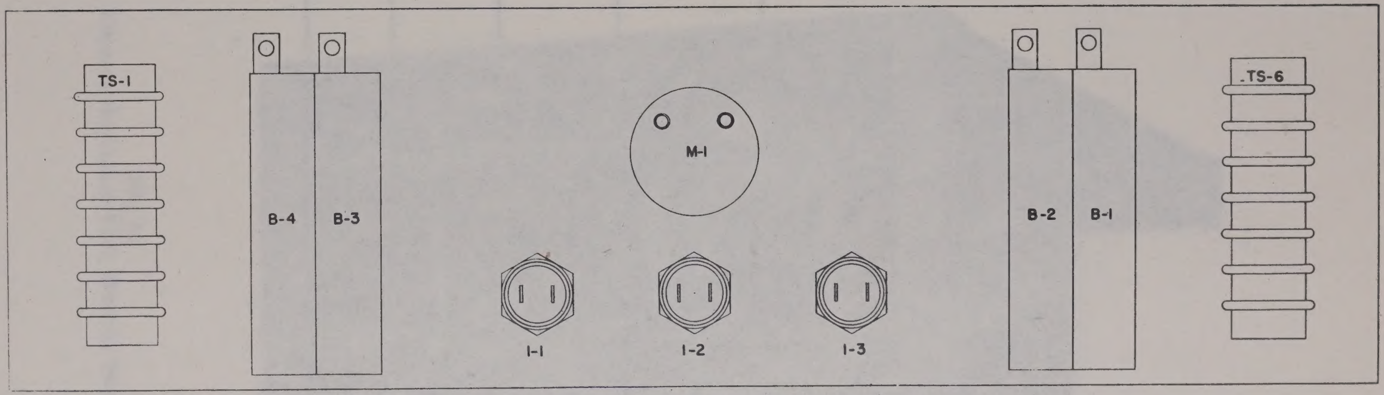

TS-6
CABLE-3
33
32
31
30
29
28
OR.
BR.
BLK.
WH.
B-1
B-2
B-3
B-4
M-1
I-1
I-2
I-3
RED
GR.
TS-1
1
2
3
4
5
6
(PANEL AS VIEWED FROM REAR OF TRANSMITTER)

Fig. 32 - Power Control Unit, Physical Wiring Diagram


TS-1
B-4
B-3
M-1
I-1
I-2
I-3
B-2
B-1
TS-6

(PANEL AS VIEWED FROM REAR OF TRANSMITTER)

Fig. 33 - Power Control Unit, Part Location Diagram

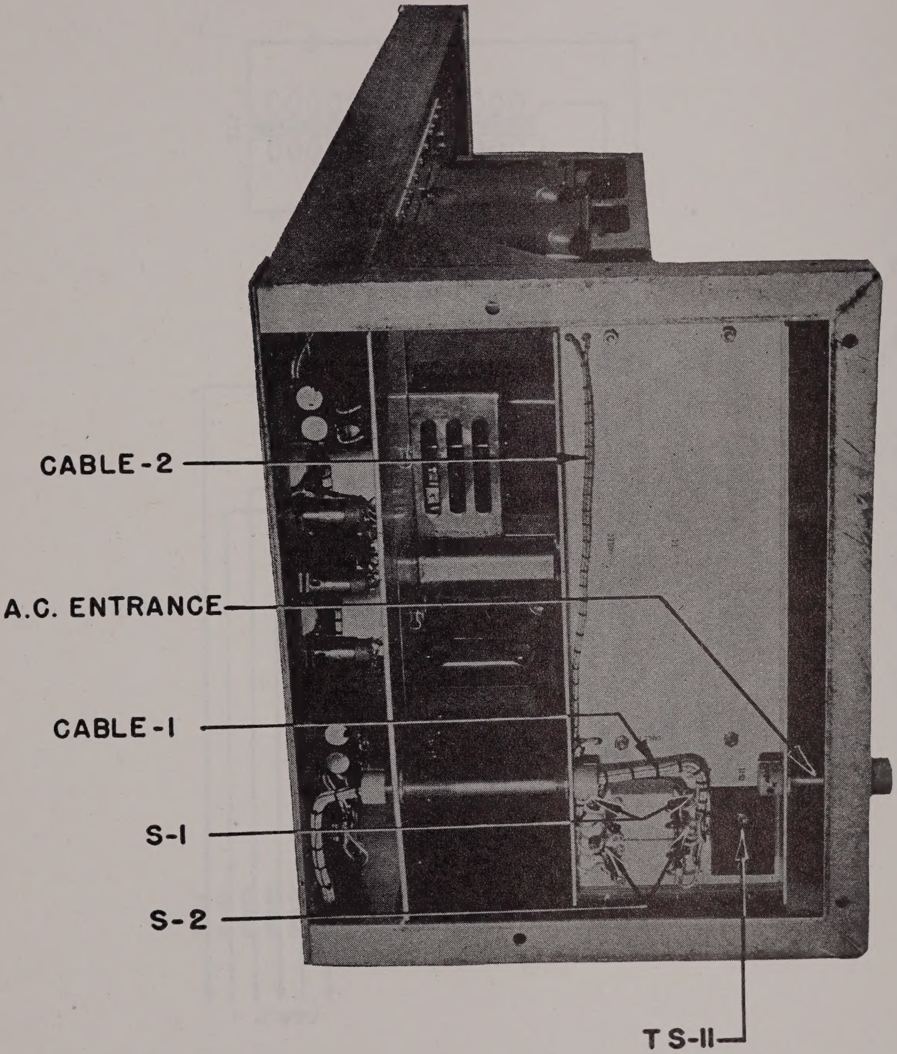

CABLE-2
A.C. ENTRANCE
CABLE-1
S-1
S-2
T S-11

Fig. 34
Voltage Regulator Unit, Bottom View

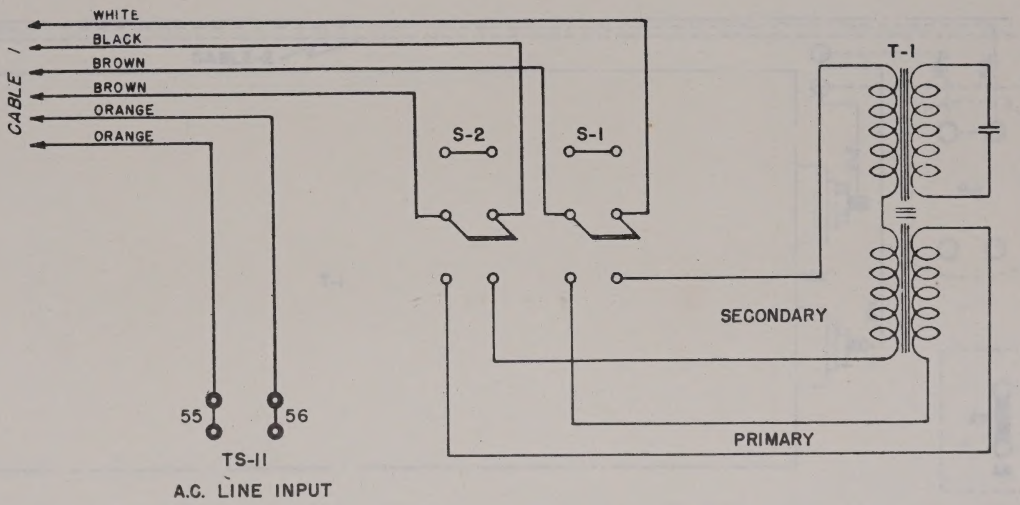
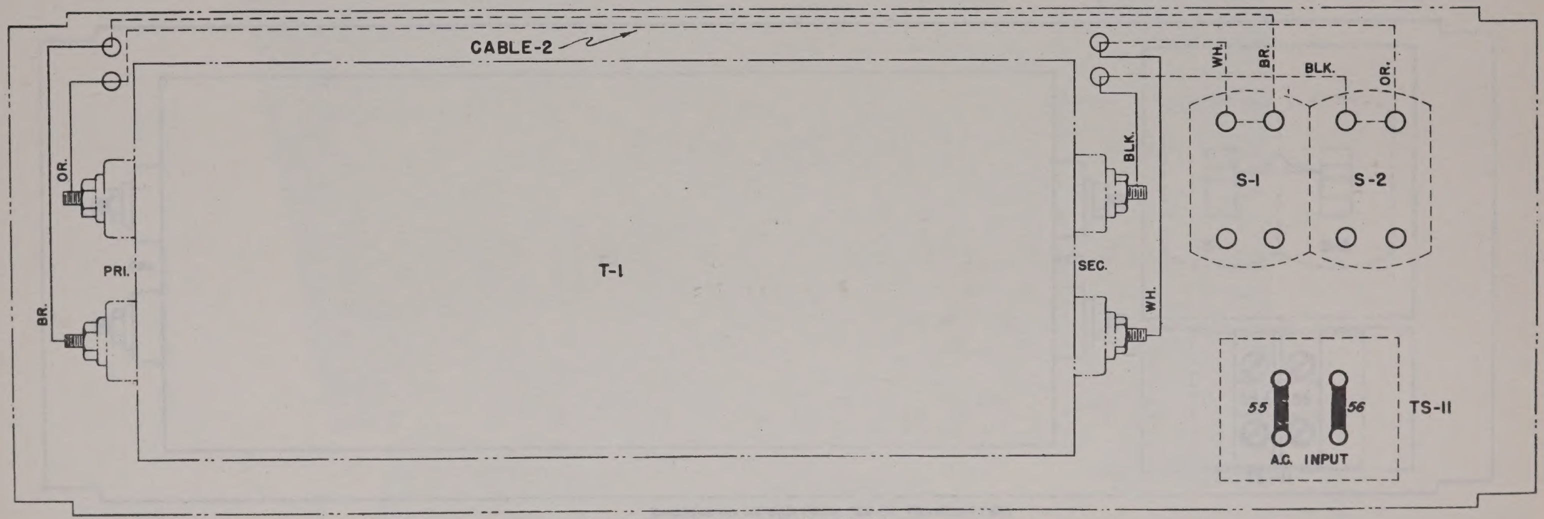
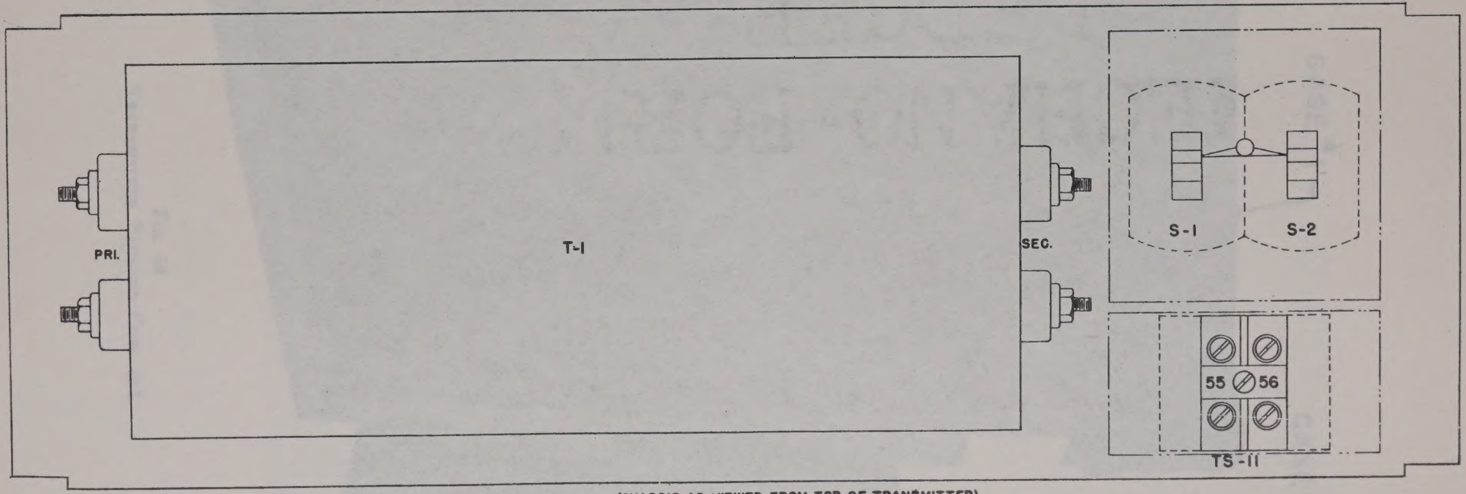

WHITE
BLACK
BROWN
BROWN
ORANGE
ORANGE
CABLE 1
S-2
S-1
T-1
SECONDARY
PRIMARY
55
56
TS-11
A.C. LINE INPUT

Fig. 35 - Voltage Regulator Unit, Schematic Wiring Diagram


CABLE-2
OR.
BR.
PRI.
T-1
SEC.
BLK.
WH.
WH.
BR.
BLK.
OR.
S-1
S-2
55
56
TS-11
A.C. INPUT

(CHASSIS AS VIEWED FROM TOP OF TRANSMITTER)

Fig. 36 - Voltage Regulator Unit, Physical Wiring Diagram


PRI.
T-I
SEC.
S-I
S-2
55
56
TS-II

(CHASSIS AS VIEWED FROM TOP OF TRANSMITTER)

Fig. 37 - Voltage Regulator Unit, Part Location Diagram

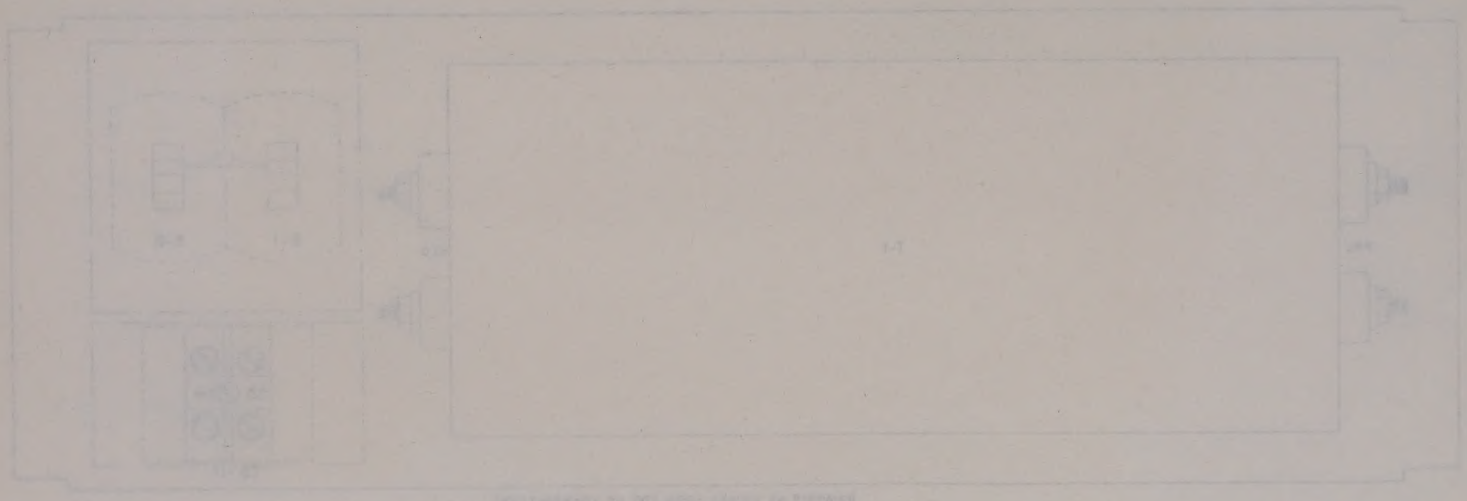


Fig. 37 - Voltage Regulator Unit, Part Location Diagram

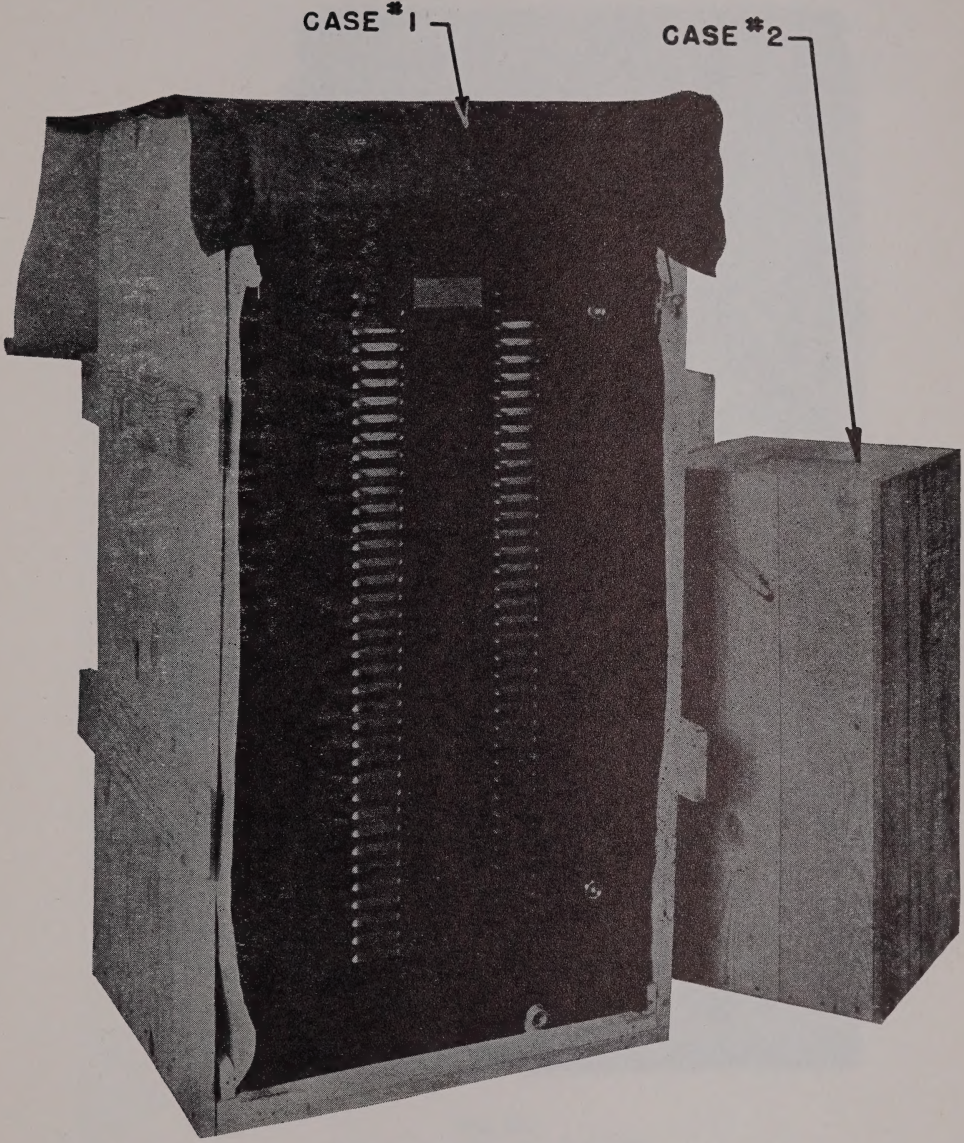

CASE *1
CASE *2

Fig. 38
Transmitter Packing Case #1

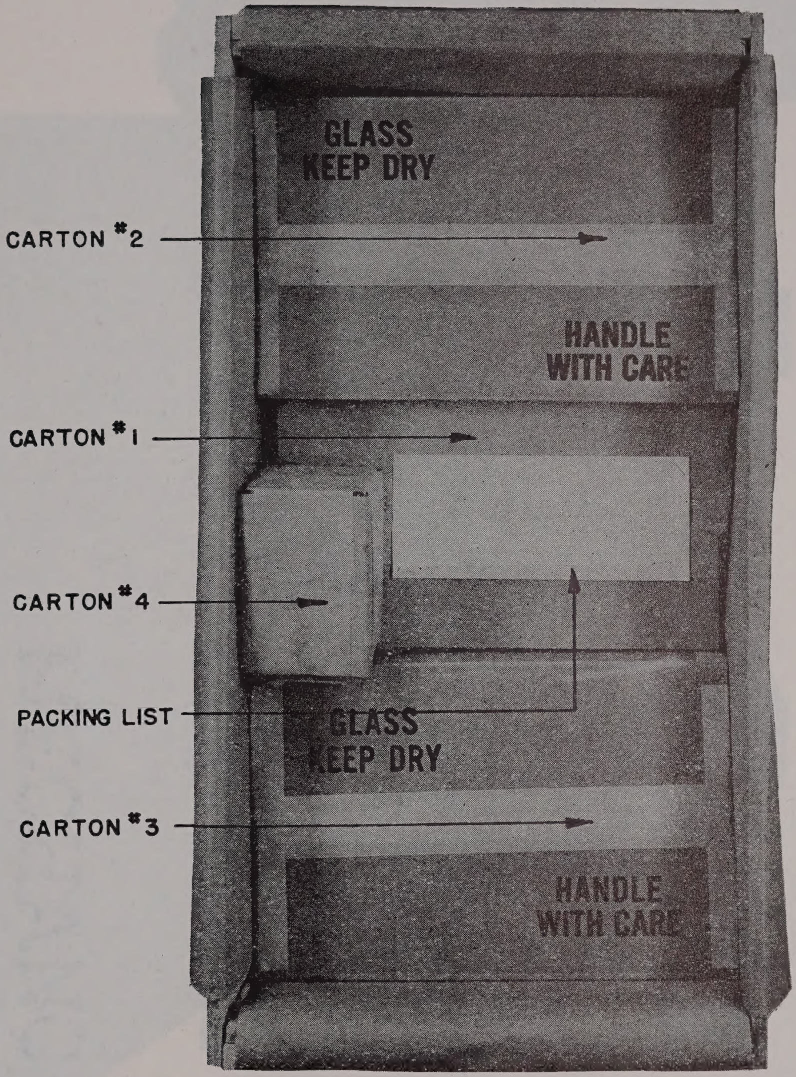

GLASS
KEEP DRY
CARTON #2
HANDLE
WITH CARE
CARTON #1
CARTON #4
PACKING LIST
GLASS
KEEP DRY
CARTON #3
HANDLE
WITH CARE

Fig. 39
TRANSMITTER PACKING CASE #2

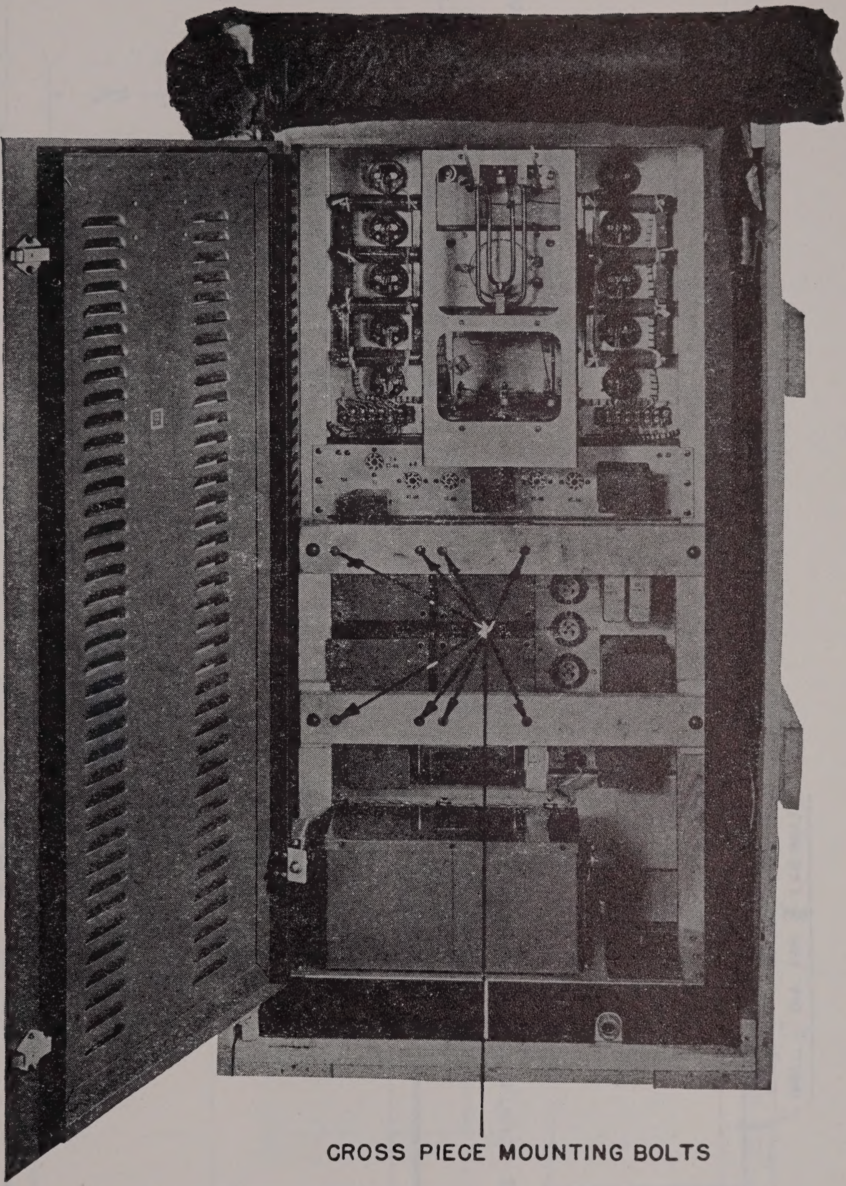
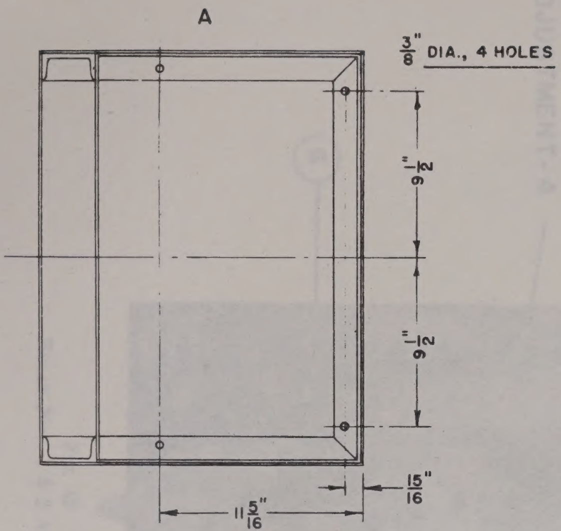
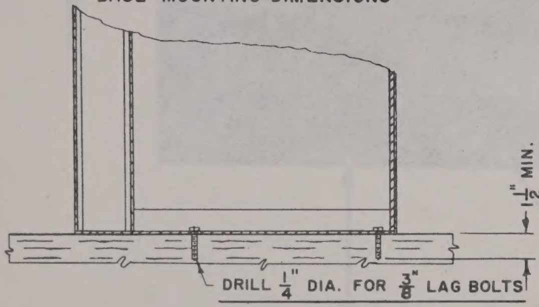

CROSS PIECE MOUNTING BOLTS

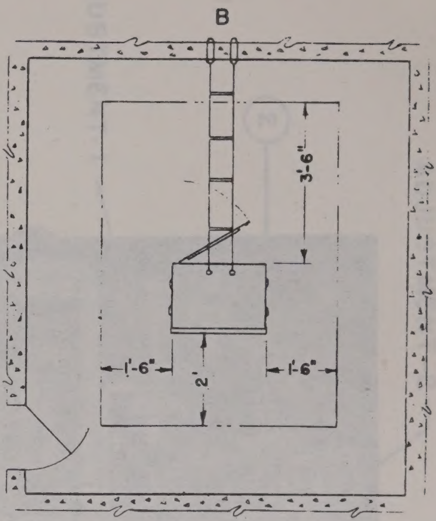
Fig. 40
Transmitter Packing Inside Cabinet View


A
3/8" DIA., 4 HOLES
9 1/2"
9 1/2"
15/16"
11 5/16"

BASE MOUNTING DIMENSIONS


1 1/2" MIN.
DRILL 1/4" DIA. FOR 3/8" LAG BOLTS

DETAILS OF MOUNTING



SUGGESTED MINIMUM CLEARANCES FOR
TRANSMITTER INSTALLATION

Fig. 41 - Transmitter Installation

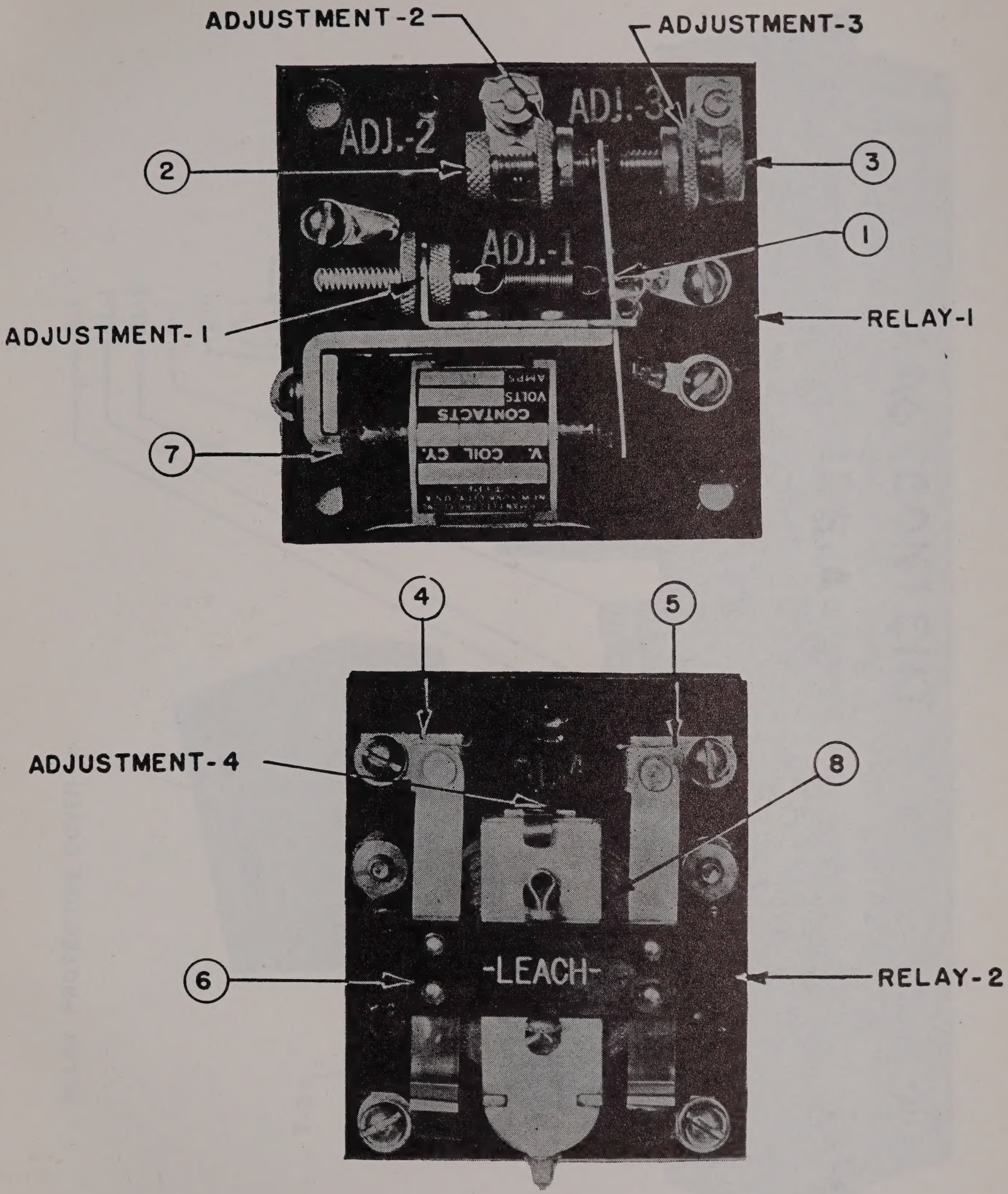

ADJUSTMENT-2
ADJUSTMENT-3
ADJ.-2
ADJ.-3
ADJ.-1
2
3
1
ADJUSTMENT-1
RELAY-1
CONTACTS
VOLTS
AMPS
V. COIL CY.
7
4
5
ADJUSTMENT-4
8
6
-LEACH-
RELAY-2

Fig. 42
Relay Nos. 1 & 2 Assembly

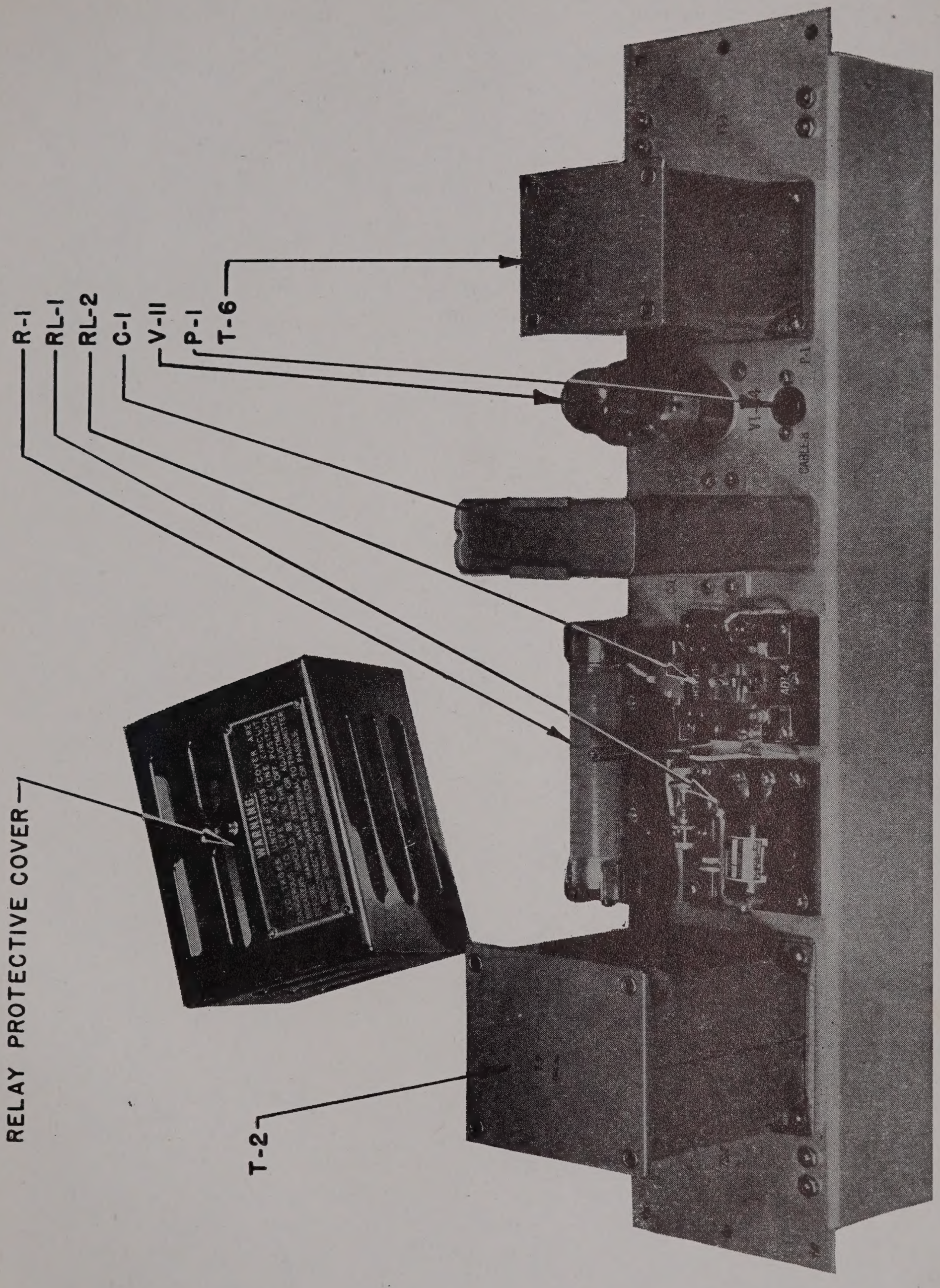

R-1
RL-1
RL-2
C-1
V-11
P-1
T-6
RELAY PROTECTIVE COVER
T-2

Fig. 43
Bias Supply Unit, Rear View, Showing Location of Relays